State Aid and Competition Policy: The Case of Bailouts in the European Union

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Abstract

Governments in the European Union frequently bail out firms in distress by granting state aid called *Rescue and Restructuring Subsidies*. This thesis consists of three chapters analyzing three different aspects of European bailouts.

In the first chapter, I use data from 86 cases during the years 1995-2003 to examine the effectiveness of bailouts in preventing bankruptcy and the determinants of bailout policy. The results are threefold. First, the estimated discrete-time hazard rate increases during the first four years after the subsidy and drops after that, suggesting that some bailouts only delayed exit instead of preventing it. Second, governments' bailout decisions favored state-owned firms, even though state-owned firms did not outperform private ones in the survival chances. Third, subsidy choice is an endogenous variable in the analysis of the hazard rate. Treating it as exogenous underestimates its impact on the bankruptcy probability. Several policy implications of the results are discussed in the chapter.

The second chapter is a theoretical study of the effects of bailouts on market structure and welfare in an international asymmetric Cournot duopoly. I adopt a common market setting, where consumers from the two countries form one market. I show that the subsidy is positive also when it fails to prevent the exit. The reason is a strategic effect, which forces the more efficient firm to make additional cost-reducing effort. When the exit is prevented, allocative and productive efficiencies are lower than in case of exit and the only gaining player is the rescued firm.

The third chapter provides evidence of political, institutional and economic determinants of bailout policies in the countries of the European Union. I use a new data set based on European Commission's rescue and restructuring aid decisions during the years 1995-2003 merged with information about electoral outcomes in European countries. The main finding is that in countries with majoritarian democratic institutions bailouts are more likely, in particular during years preceding elections. Since bailouts are a targeted fiscal policy, the evidence supports the theory of Persson and Tabellini (2000) predicting that electoral systems shape incentives for fiscal policy choices.

Keywords:
Bailout, State aid, Competition policy, European Union, Rescue and restructuring aid

Zusammenfassung

Die Regierungen in der Europäischen Union retten Unternehmen in Schwierigkeiten durch staatliche Rettungs- und Umstrukturierungsbeihilfen. Diese Dissertation besteht aus drei Kapiteln, die drei verschiedene Aspekte der europäischen Rettungs- und Umstrukturierungsbeihilfen analysieren.

Im ersten Kapitel nutze ich Daten von 86 Fällen aus den Jahren 1995-2003 um zu prüfen, wie wirksam die Beihilfen bei der Konkursprävention sind und welche Determinanten sie haben. Es gibt drei Ergebnisse. Erstens steigt die geschätzte diskrete hazard rate in den ersten vier Jahren nach der Subvention und sinkt danach, was nahelegt, dass einige Sanierungen den Konkurs eher verzögern als verhindern. Zweitens, Regierungen favorisieren staatliche Unternehmen bei Beihilfeentscheidungen, obwohl diese keine besseren Überlebenschancen haben. Drittens, die Wahl, ob Rettungs- oder Umstrukturierungsbeihilfe gewärt wird, ist eine endogene Variable in der Analyse. Wenn man sie als exogen betrachtet, unterschätzt man die Auswirkungen auf die Konkurswahrscheinlichkeit.

Das zweite Kapitel ist eine theoretische Studie über die Auswirkungen von Bailouts auf Marktstruktur und Wohlfahrt in einem internationalen, asymmetrischen Cournot – Duopol. Grundannahme ist ein gemeinsamer Markt, auf dem Verbraucher aus zwei Ländern zusammenkommen. Es wird gezeigt, dass die optimale Beihilfe positiv ist, auch wenn der Marktaustritt einer Firma nicht verhindert werden kann. Der Grund hierfür ist ein strategischer Effekt, der die effizientere Firma zu einer zusätzlichen kostenreduzierenden Maßnahme veranlasst. Wird der Marktaustritt verhindert, ist Effizienz geringer, und der einzige aufholende Teilnehmer ist die gerettete Firma.

Das dritte Kapitel enthält empirische Belege der politischen, institutionellen und wirtschaftlichen Determinanten der Sanierungsubventionspolitik in den Ländern der Europäischen Union. Ich nutze einen neuen Datensatz über Entscheidungen der Europäischen Kommission über Rettungs- und Umstrukturierungsbeihilfen während der Jahre 1995-2003 zusammen mit Informationen über Wahlergebnisse in den Europäischen Ländern. Das wichtigste Ergebnis ist, dass die Beihilfen in Ländern mit Mehrheitswahlsystem wahrscheinlicher sind, insbesondere während der Jahre vor Wahlen. Die Resultate sprechen für die Theorie von Persson and Tabellini (2000), die vorhersagt, dass Wahlsysteme die Anreize für politische Entscheidungen ausprägen.

Schlagwörter:
Sarnierung, Staatliche Beihilfe, Wettbewerbspolitik, Europäischer Union, Beihilfen zur Rettung und Umstrukturierung

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Chapter 1

Introduction

1.1 Motivation, Aims and Scope

When a large firm gets in trouble and its employees face the danger of losing their jobs, a hot public discussion often takes place: to bail out or not? A strong conflict of interests heats up the debate: employees and shareholders on the one side, competitors and taxpayers on the other side. Politicians are tempted to use the situation for their own political advantage. Opinion-makers with leftist views exercise the power of their arguments against their right-wing rivals. Every time such a debate takes place, economic expertise is needed so that a rational decision can be made. But what is a rational bailout decision? What are objectives of bailouts and under which conditions are they achieved? What are the effects of bailouts on other market participants? Which aid instruments and which decision procedures guarantee the best outcome? Finally, why do some firms in trouble get bailed out and others do not? Finding satisfactory answers to these questions is in the interest of all citizens of the European Union (EU) and motivates this thesis.

To decide on a bailout, policy makers at both country- and EU-level are involved and the interests of all market participants are taken into account. While the government decides whether to help the firm in trouble, the European Commission investigates if the interests of the firm's competitors and consumers in all EU member states are not threatened. With so many players each having individual objectives and acting within a broad set of legally feasible strategies, a bailout game is necessarily a complex one. Economics has developed useful tools to deal with such problems. Rigorous logic of economic theory and the richness of statistical methods for data analysis make economics well suited to address such complex policy issues.

An economic effects-based approach to state aid and state aid control in the EU plays an important role in the reform of this aspect of the European competition policy started

by the Competition Commissioner Neelie Kroes in June 2005.[1] Soft-law provisions in many areas of state aid, including bailouts, have been revised. For state aid control in general economists developed a balancing test which weighs the benefits of aid (e.g. curing market failure, improving cohesion) against its costs (e.g. distortion of competition, distortion of dynamic incentives, shadow cost of taxation) and recommends intervention only when the former exceeds the latter (Friederiszick et al., 2006). However, economic discussion of bailout policy as a particular kind of state aid has been limited. This thesis is a contribution to such a debate.

The aim of this study is twofold. First, it shall improve the understanding of how bailouts in the European Union have worked in the past. Second, it shall provide general knowledge about how bailouts affect market equilibria in their full complexity. In order to achieve these aims, I build on methodologies and research results from three different areas of economics. From empirical industrial organization I draw methods to study the effectiveness of bailouts empirically. Strategic trade theory provides a framework to theoretically study both the impact of bailouts on welfare of the bailed-out firm, its competitors and consumers, as well as incentives of governments to use bailouts strategically. Finally, ideas about institutional determinants of bailouts come from political economics. I believe that such a comprehensive approach is appropriate if one wants to see the full picture of bailouts' incentives, implementation and outcomes.

1.2 Related Literature

A bailout is a subsidy granted by a government to a firm on the verge of bankruptcy. In the EU, bailouts are controlled at the supranational level within the state aid control process which is a part of the European competition policy. Soft laws issued by the European Commission regulate this process in detail. For bailouts (called in the EU language *rescue and restructuring* or *R&R* subsidies), guidelines were issued in 1995 and updated in 1999 and 2004.[2] Section 2.2.2 presents them briefly, and Lienemeyer (2006) provides a detailed discussion.

1.2.1 Rationale for bailouts

The usual rationale for state intervention proposed by economists is alleviation of market failures. When the market delivers inefficient goods allocation, state aid can potentially

[1] State Aid Action Plan: less and better targeted state aid: a roadmap for state aid reform 2005 to 2009, Consultation document, 7.6.2005

[2] "Community Guidelines on State Aid for Rescuing and Restructuring Firms in Difficulty", Official Journal of the European Union, 2004/C 244/02.

remedy the problem. Time inconsistency in the objectives of a benevolent government is an example of a market failure which can justify bailouts. If it is optimal for a benevolent government to bail out once a firm goes bankrupt, even though *ex ante* bailouts are bad for welfare, firms have incentives to become unprofitable and extract rents from the state, which leads to a reduction in the country's welfare. Technically speaking, the optimal solution of the dynamic game is not subgame-perfect. Segal (1998) showed that this problem is present in a model of a monopoly where the monopolist does not internalize all social surplus from production (does not price-discriminate perfectly). To secure the social surplus, a benevolent government bails out such a loss-making monopolist. The loss of welfare due to this market failure exceeds by far the deadweight loss of monopoly pricing. Boadway et al. (1995) obtain similar results in a model with uncertainty about efficiency of production technology. When investment is not observable by the government, firms underinvest and "pretend" they were unlucky to draw a bad technology. A solution to this soft-budget constraint problem is *ex ante* commitment of the government not to intervene, which is a rationale for the European state aid control. In such a case, benevolent governments are happy to collectively limit their freedom in state aid policy (Reinhard, 2002). Depending on particular details of the market failure, other ways to reduce soft-budget constraints suggested in the literature include decentralization of decision making (Dewatripont and Maskin, 1995), privatization (Shleifer and Vishny, 1994; Boycko et al., 1996) and separation of social good from private goods provision (Röller and Zhang, 2005).

Another example of a market failure which could justify a bailout by a benevolent government is market power. Firms with market power interact strategically. They can engage in a range of strategies to get rid of a rival, e.g. predatory pricing (Klevorick, 1993). When in addition the market is international, governments have incentives to help their national champion to gain a strategic advantage over its foreign rivals (Brander and Spencer, 1983; Leahy and Neary, 1997; Lahiri and Ono, 2004). Moreover, subsidy competition among governments can be detrimental to joint welfare, which is another rationale for European state aid control (Collie, 2000, 2002). Most of models in this literature assume symmetry of firms and countries, but in order to model bailouts, firms need to be asymmetric in efficiency. Optimal production subsidy is sensitive to this assumption. In an asymmetric Cournot duopoly, Zhao (2001) showed that welfare is U-shaped in the degree of asymmetry. If the difference in production costs is large enough, reducing the asymmetry through a subsidy results in lower welfare. The less efficient firm captures a larger share of the market from the more efficient competitors and reduces productive efficiency so much that gains in allocative efficiency from more competition do not compensate it. Only when cost differences are small, decreasing them improves welfare.

Optimal policy of a benevolent government depends therefore on the initial asymmetry in production efficiency among firms (see e.g. Lahiri and Ono (1988); Neary (1994); Röller and Sinclair-Desgagne (1996); Leahy and Montagna (2001)).

1.2.2 Political economics of bailouts

If the assumption of benevolent government is dropped, a wide spectrum of other mechanisms leading to bailouts is possible. Positive theory of government proved useful in explaining policy in regulation (Duso, 2002), privatization (Börner, 2005), investment patterns (Cadot et al., 2006) and it certainly plays a role in allocation of state aid. According to the estimates of Neven and Röller (2000), over 90% of variation in allocation of state aid to manufacturing in the EU can be explained by political variables.

A large literature on electoral cycles suggests that fiscal policy before elections can be chosen strategically to increase reelection chances (for a survey, see Franzese (2002a)). For example, electoral cycles exist when policy makers have an informational advantage over voters and use this advantage to manipulate the result of elections. Rogoff (1990) models electoral cycles as a signalling game in which incumbent governments convince voters about their competence by using visible fiscal policy before elections. In Harrington (1993) voters care about economic performance but are uncertain about the efficacy of policy measures in improving it. This creates incentives for the incumbent government interested in reelection to choose a policy which is well-received and not necessarily efficient. Even constitutions can create incentives for politicians to use particular fiscal policy instruments. Persson and Tabellini (2000), Lizzeri and Persico (2001) and Milesi-Ferretti et al. (2002) developed models where politicians in countries with majoritarian electoral rules prefer to use targeted public spending (e.g. bailouts, local public goods) than broad redistribution programs benefiting all citizens. In such countries electoral competition is usually limited to a heated fight in a few districts with swing voters. Therefore, politicians choose the policy which allows them to target voters in those districts. In contrast, proportional electoral rules encourage politicians to seek support from the largest group of voters possible, resulting in broad social transfers as preferred fiscal policy. Milesi-Ferretti et al. (2002) find evidence for this prediction.

Reelection concerns may lead to inefficient projects being undertaken, e.g. an attempt to bail out a firm without chances for survival. Robinson and Torvik (2005) show that in order to win elections incumbent governments might undertake projects with negative surplus. Since no other politician would undertake such a project, the incumbent can credibly commit to it. Therefore, such a policy guarantees that voters benefiting from the project being undertaken will reelect the incumbent. In Dewatripont and Seabright (2006) politicians make effort to demonstrate their diligence. Voters elect the politician

who makes more effort, even if ex post it sometimes turns out that the projects are loss-making.

Other political factors affecting the choice of fiscal policy include partisan cycles (Hibbs, 1977; Kalt and Zupan, 1984; Alesina, 1988; Cusack, 1997) or veto player problems in coalitions (Franzese, 2002b; Tsebelis, 2002).

Influence of special-interest groups is another element of positive economic theory which can persuade incumbents to bail out. Well organized and concentrated groups are able to overcome free-rider problems and effectively lobby decision makers (Olson, 1965; Stigler, 1971; Peltzman, 1976; Becker, 1983). This insight was used in trade theory to generate a lot of literature on political economics of trade protection (e.g. Baldwin (1985); Grossman and Helpman (1994); Bradford (2003)). Asymmetry between gainers and losers of a particular policy choice might determine whether the policy will be adopted or not: in Fernandez and Rodrik (1991) uncertainty about who gains and who loses creates a status-quo bias. In Krueger (1990) trade protection persists because the identity of the losers from abandoning protection and the magnitude of their loss are clearly defined, while the winners are dispersed and their gain uncertain - thereby creating a free-rider problem. Baldwin and Robert-Nicoud (2007) use a similar idea to explain why governments subsidize firms from ailing sectors. In their model, there is a strong asymmetry in incentives to lobby between expanding and contracting industries. Entry in growing sectors erodes gains from lobbying. In declining sectors, the gains exist and do not attract entry as long as they are not too large. That is why losers lobby harder.

Last but not least, corruption can determine subsidy distribution. Shleifer and Vishny (1994) study a bargaining game with incomplete contracts between politicians and managers. In the equilibrium of this game, politicians subsidize loss-making firms in return for bribes and political benefits from excess employment. Acemoglu and Verdier (2000) suggest that there is actually a trade-off between market failures and corruption, which is generated by imperfect monitoring of self-interested bureaucrats who collect information, make decisions and implement policies. Ades and Di Tella (1997) show empirically that corruption has a negative impact on effectiveness of industrial policy. In the presence of corruption, investment generated by industrial policy can be up to 44% lower.

1.2.3 Empirical analysis of bailouts

In economic literature, bank bailouts have probably received the most attention. Conventional wisdom is that deposit insurance such as a pro-bailout policy leads to more risk taking. In bad states of the world this can cause a financial crisis, which would have a negative externality on the whole economy. However, recent contributions put this result into question. Cordella and Yeyati (2003) and Gropp and Vesala (2004) suggest that central

bank's commitment to an explicit bailout policy in bad states of the world creates a value effect, which discourages risk taking by more than the moral hazard problem encourages it. Using bank ratings and other data from OECD countries, Hakenes and Schnabel (2004) and Gropp et al. (2007) show that commitment to a pro-bailout policy intensifies competition in the market and increases risk taking of protected banks' competitors, but has no impact on risk taking of insured banks.

Large banks are believed to be "too-big-to-fail", as the Comptroller of the Currency in the US Congress once called them (Kaufman, 2003). Using event study methodology, O'Hara and Shaw (1990) estimated the value of this public statement by the Comptroller and found that it was beneficial to the large banks. Rime (2005) used two ratings of banks issued by the rating agencies Fitch and Moody's: a rating considering all factors influencing the ability of banks to repay their debts and a rating reflecting only the intrinsic ability of banks to repay their debt. Regressing the former on the latter with several control variables included, he found that the size of the bank in terms of market share and the size of deposits significantly increases the first rating, which can be interpreted as evidence of the too-big-to-fail effect.

To the best of my knowledge, only two cross-industry studies on bailouts exist. Using micro-level data from Slovenian manufacturing, Schweiger (2006) investigated the impact of state aid granted to ailing firms on static and dynamic efficiency. In her data set all bailed-out firms survived. However, aid caused an increase of their market shares without changing their total factor productivity at the same time. This suggests that the aid was distortive.

The study by Chindooroy et al. (2005) is the first empirical paper about bailouts approved by the European Commission. It contains a descriptive analysis of a data set based on the Commission's decisions and a reduced-form analysis of factors influencing survival chances. In contrast to rescues in Slovenian manufacturing, European bailouts fail frequently, in particular when only rescue aid is granted (with mortality rate close to 50%). The failures were attributed to business cycle. This study has several shortcomings. The methodology makes use of subjective opinions for reasons of difficulties which are not clearly defined and not exclusive, e.g. "poor management" and "low competitiveness" are treated as two different variables. A temporal dimension is not explicitly present. Finally, endogenous allocation of rescue vs. restructuring subsidy type to firms with different characteristics is not taken into account. The second chapter of my thesis can be seen as an extension and a continuation of this study.

1.2.4 Alternatives to bailouts

Another strand of literature related to bailouts concerns bankruptcy procedures. To maximize efficiency on the way out of insolvency, bankruptcy law in most countries offers a reorganization procedure. Reorganization has a lot in common with bailouts (e.g. the same objective to save jobs and know-how), but taxpayers do not pay for it. If reorganization procedures were effective in rescuing firms from bankruptcy and at the same time *ex ante* discouraging firms from going bankrupt, the intervention of the government would not be necessary or at least could be very limited. Therefore, good design of bankruptcy law is very important for limiting the "supply" of firms to bail out and it might be beneficial to consider the design of R&R aid procedures in connection with bankruptcy law. Berkovitch et al. (1998) show that the bargaining game between creditors and the firm in distress should be constrained, so that the *ex ante* optimal outcome can be achieved also when it is not subgame-perfect. In particular, managers should be "punished" during reorganization, so that their incentives to avoid bankruptcy *ex ante* are stronger and moral hazard is limited. Cornelli and Felli (1997) focus on creditors' rights and recommend that in case of insolvency, creditors should be given ownership rights to the firm before choosing the reorganization plan. In such a situation *ex ante* efficiency can be achieved.

The most studied reorganization procedure is surely Chapter 11 of the US Bankruptcy Act. For example, economists estimated the hazard rate of successful emergence from protection, i.e. the probability of successful reorganization in time period i conditional on surviving until i. The hazard estimated by Bandopadhyaya (1994) and Li (1998) increases in time since filing for bankruptcy. The studies of pricing by airlines under Chapter 11 protection agree in that insolvent airlines price aggressively. They disagree, however, in the assessment of the rivals' pricing: Borenstein and Rose (1995) show that the competitors do not react to the price cuts, while Barla and Koo (1999) provide evidence of aggressive pricing by insolvent airlines' rivals.

Among the EU countries large differences in bankruptcy law design exist. According to Couwenberg (2001) and La Porta and de Silanes (1998), creditors have the weakest position in France, where they are automatically obliged not to start individual collection proceedings and keep the credit lines open, while management remains in charge of operations. In contrast, in the UK and Germany after 1999 creditors actively take part in reorganizing the debtor's operations. Creditreform (2002) provides annual surveys with statistics on insolvencies across European countries.

1.3 Contribution of the thesis

1.3.1 Results

This thesis offers a comprehensive economic analysis of bailouts in the European Union, which is divided into three chapters.

In the second chapter I study empirically the outcomes of all bailout cases which were approved by the European Commission during the years 1995-2003. To make this feasible, I developed a data set by merging information from four sources: decision texts of the Commission, Chindooroy et al. (2005) report to the Commission, the AMADEUS data base and web sites of the firms concerned. The resulting panel data set contains information on 79 firms from 10 EU member states, which were followed from the year they were rescued until 2003 or earlier bankruptcy. With the data I estimated a hazard rate of exit after the bailout, i.e. the probability of going bankrupt in year i conditional of surviving until year i. The results show that in the first four years after the bailout firms exit at an increasing rate. This indicates that a bankruptcy after the bailout does not occur randomly, but is a result of a wasteful behavior: firms went bankrupt with delay, because they could afford to survive a bit longer with the means granted by the state and possibly by other sources. A total of 29.3% of the subsidized firms exit after getting an R&R subsidy.

Moreover, evidence shows that firms receiving a restructuring subsidy go bankrupt less often than rescue aid receivers. Allocation of these two types of aid to different firms can therefore be a way to discriminate. The analysis of the choice of subsidy type suggests that state-owned firms receive restructuring aid with higher probability due to governments' preference to sustain public employment. All state-owned firms which were later privatized, as well as all those older than 100 years, received exclusively restructuring aid. This special position of state-owned firms is likely to cause soft-budget constraints. I also find a strong time trend in the data: after the year 2000 rescue aid was more likely than restructuring aid, while the opposite is true for the years up to 2000. As a consequence of this tendency, more firms are granted aid which is less efficient in preventing bankruptcy.

The third chapter is devoted to a theoretical analysis of the effects of bailouts on the market equilibrium. The approach is essentially normative and assumes a benevolent government maximizing total welfare. Another key assumption is that the ailing firm faces the risk of exit because it is inefficient compared to its competitors, i.e. it has a too high marginal production cost. In the benchmark situation without the bailout, the inefficient firm goes bankrupt and only its competitor remains in the market. Competition is modeled as a homogenous good Cournot duopoly, which I modified to include the European common market idea: each firm is located in a different country and consumers are split

between the countries. The results are essentially a corner solution to an asymmetric two-stage game where firms noncooperatively set cost-cuts in the first stage and quantity in the second stage.

In such a setting, a successful bailout is beneficial for the rescued firm, but it leaves the competitor with smaller profit and consumers with higher price than in the benchmark case. The price increases, because the competitor is so efficient that as a monopolist it would charge less than in a duopoly with the inefficient firm. Still, the government of a country with a small share in consumer surplus, i.e. government caring relatively more about the profits than about the price, chooses to bail out when her objective is to maximize total welfare of the country. Total welfare of the whole union is however reduced and a benevolent supranational regulator should prohibit such a subsidy.

The optimal strategy for governments of countries with a large share in total consumer surplus, i.e. governments caring relatively more about the price than about the profits, is very different. They subsidize the ailing firm, but not sufficiently to keep it in the market, so that the firm is not rescued. However, the strategic effect of the subsidy on the foreign firm forces this firm to cut costs more and, being a very efficient monopolist, to charge a low price. In such an equilibrium consumer surplus is greater than in the benchmark case and the total welfare also increases.

Since Okun (1975), economists have studied the trade-off between efficiency and equality extensively. Not always equality excludes efficiency. Blank (2002) notes that when public assistance does not alter receiver's behavior in an undesirable way or when it allows to access long-term investment, the trade-off does not exist. However, in case of bailouts this trade-off is severe. Bailouts which achieve equality objectives, i.e. save jobs, reduce efficiency. Bailouts which fail to save jobs improve efficiency. The reason is that a bailout results in a detrimental for total welfare change of asymmetry in productive efficiency between firms.

The empirical results of the fourth chapter shed light on why bailout policy is so different across EU member states. The data set was created by merging information from many different sources (see table 4.6). The resulting panel contains variables describing institutional, political and economic differences among member states of the EU between 1992 and 2003.

The main result of this chapter is the finding that in countries with more majoritarian democratic institutions bailouts are more likely. In addition, in countries with plurality rule in elections to the lower house of legislators bailouts are more likely during years preceding elections. This finding is consistent with theoretical predictions of Persson and Tabellini (2000) showing that electoral systems shape incentives for fiscal policy choices. Targeted fiscal policy like bailouts can be used to convince geographically defined districts

with swing voters to support the incumbent. Thus the chapter provides evidence that bailouts are used by some governments as pork barrel to improve their reelection chances.

Another result of the fourth chapter relates to political determinants of bailouts. Political strength of governments also matters for bailout decisions. On average, one-party governments bailed out more frequently than coalition governments. Moreover, the more seats in the lower house of the legislature supporting the government, the more likely bailouts. This result is consistent with Tsebelis (2002), in that the more veto players in the political system, the more difficult it is to make decisions.

1.3.2 Implications for policy

This thesis contributes to the debate about welfare standard in state aid, suggests improvements in bailout control procedures and motivates the effort of the state aid reform to introduce an effects-based approach.

The results of the normative bailout model in the third chapter support the notion of total welfare as the appropriate standard to assess distortion of competition caused by R&R aid. The legal basis for the European state aid control, Article 87 of the EC Treaty,[3] states that aid is generally prohibited since it distorts competition and affects free trade between member states, but the exact economic definitions of these terms are left open. In state aid, distortion of competition used to be interpreted as the effect on profits of the beneficiaries' rivals (Garcia and Neven, 2005), while in other areas of competition policy it is understood as harm to consumer welfare (Neven and Röller, 2005). Nitsche and Heidhues (2006) suggest that a total welfare standard is more suitable, since none of the two objectives on its own can capture all effects of aid on competition and trade in the common market.

When a bailout succeeds, both the beneficiary's rival and consumers lose. Therefore, there is no conflict between the objectives and total welfare is unambiguously reduced. However, and paradoxically, failing bailouts are beneficial to consumers and they improve total welfare, even though they harm the beneficiary's rival. Competitor's welfare stands then in opposition to consumer gains, and only the total welfare objective is able to recognize the overall welfare effect of such a bailout. The reason for this surprising difference between the two bailout scenarios is their very different impact on productive efficiency: when the inefficient firm survives, it steals some market from its competitor who can produce more cheaply, so that the average production cost is high. When the inefficient firm exits, the rival becomes more efficient due to strategic effects of the bailout and supplies the whole market, keeping the average production cost low. These results mirror the recent contributions on deposit insurance in banking, which was found to have

[3] OJ C 325, 24.12.2002, p.67.

a pro-competitive effect on banks not covered by this insurance (Hakenes and Schnabel, 2004).

Another policy-relevant outcome of this study relates to bankruptcy laws. A comparison of mortality ratios and hazard rates of firms under Chapter 11 protection in the US and R&R aid beneficiaries in the EU suggests that Chapter 11 may be performing better. Literature about design of bankruptcy procedures suggests ideas about how to provide all stakeholders with incentives to avoid bankruptcy *ex ante* and the design of R&R aid guidelines could make use of them. One clear direction is to strongly encourage managers to avoid bankruptcy and R&R aid *ex ante* by conditioning the aid on sending a signal to the market that the managers had failed. Moreover, strengthening protection of creditors' rights is beneficial for *ex ante* efficiency (Cornelli and Felli, 1997), even though *ex post* it would sometimes mean liquidation instead of restructuring.[4] It would also reduce the price of credits to firms in distress and thereby limit the need to bail out.

Finally, this thesis provides evidence of electoral motivations of politicians in choosing to bail out. Since such motivations play a role in bailout decisions, the economic effects-based approach implemented by the Commission is very useful to counterbalance this phenomenon and should be pursued further for the benefit of the EU's economy.

[4]Creditreform (2002) write: "One problem that all national laws have in common is that they offer too little protection from creditors for the companies concerned, thus hampering the chances of successful restructuring and rescue concepts. More effort is put into finding a culprit than into getting a viable company back on its feet."

Chapter 2

Effectiveness of bailouts in the European Union

2.1 Introduction

The objective of this paper is to investigate the effectiveness of bailouts in the European Union (EU). Bailouts in the EU are pursued by governments in order to save endangered jobs, support development in certain regions, or promote a certain type of economic activity. Such subsidies also have an impact on competition in the European common market, therefore the European Commission strictly controls them: whenever a government wants to bail out a firm, it must get an approval from the Commission. I examine the effectiveness of bailouts in maintaining survival of firms in distress and I assess European bailout control from this perspective. I also provide empirical evidence on the criteria used by governments in their bailout decisions.

The reasons why some governments bail out are often of political nature. Helping a firm in trouble draws media attention and voters' sympathy, as in the case of Germany's chancellor, Gerhard Schröder, who gained on political support after bailing out the construction firm Philipp Holzmann. Potentially, there are also economic reasons for bailouts. Due to time-inconsistency of their objectives, governments may lack commitment to a hard no-bailout policy and thereby create soft-budget constraints for firms (Boadway et al., 1995). This is particularly likely in the case of state-owned firms, where there is no separation of ownership and creditor rights (Lin et al., 1998) and where social goods are often produced (Röller and Zhang, 2005). If a failing firm is a monopolist in providing statewide services necessary for economic activities, e.g. railways, a bailout may be needed to avoid a large negative externality on the whole economy (Segal, 1998). A bailout might also be a part of the strategic trade policy with the aim of increasing the market power of domestic firms, at the cost of competing firms from other countries

(Głowicka, 2005; Neary, 1994). Finally, if the bankruptcy results in many lost jobs in a region with high unemployment, a bailout might be socially justified.

Bailouts are frequently undertaken by EU governments[1] and paid with tax revenues. Between 1992 and 2003, 79 firms in difficulty were supported with per firms aid often expressed in billions of euros.[2] Two types of aid can be granted: rescue aid if governments support firms for a short period of time to help them work out a plan of further action and restructuring aid when the restructuring process in the firm is subsidized. Every bailout decision must be notified to the European Commission. This is required, because a bailout is a highly selective subsidy: its recipient is one specific inefficient firm, which cannot stay in the market without public support. This kind of aid is likely to distort competition, since it acts directly against competitive forces, which led to the risk of exit. Such practices are forbidden in the EU by the European competition law, but they can be granted an exemption according to the Article 87(3) of the EC Treaty. Here, countries' industrial policies and EU's competition policy meet and engage in a battle: governments bail out firms of their choice pursuing their own unilateral policies, but the Commission forbids the aid if it adversely affects fair competition in the common market. Bailouts in particular are regulated by the *Community Guidelines on State Aid for Rescuing and Restructuring Firms in Difficulty*[3] and in the EU terminology are called rescue and restructuring (R&R) aid. The European state aid control is now under a "comprehensive, coherent and far-reaching reform" with an objective of "less and better targeted state aid."[4] More economic approach to aid control is introduced in several state aid areas (Friederiszick et al., 2006). For this process, a better understanding of how R&R subsidies have worked in the past is crucial.

Bailout control takes place only in Europe, as there is no equivalent bailout policy in the United States. A recent exception is perhaps the Air Transportation Stabilization Board created by the Congress in 2001 with the objective of supporting airlines survival after the terrorist attacks on the World Trade Center. Vig (2004) describes the activities of this Board as a dismal failure, since none of the big carriers took part in the loan guarantee program announced by the Board. The reason was that the carriers did not want to give

[1] A bailout does not need to be a transfer of resources, it may also be a soft position in debt recovery. For example, when firms in a deteriorating condition do not pay taxes or social security obligations and public institutions are more patient in recovering the debt than a private creditor would be, the firm gets an advantage over its competitors. This was the main issue in the case C-276/02 in the European Court of Justice, as discussed in Nicolaides and Kekelekis (2005).

[2] For example, in 2002 Bankgesellschaft Berlin AG received EUR 9,7 bn rescue and restructuring aid, while the total aid, less agriculture and railways, granted by 15 EU member states amounted to EUR 49 bn.

[3] OJ C 244, 1.10.2004, p.2.

[4] *Reforming Europe's State Aid Regime: An Action Plan for Change*, speech by Neelie Kroes, who is a Member of the European Commission in charge of Competition Policy, during the Wilmer Cutler Pickering Hale and Dorr and the University of Leiden joint conference on European State Aid Reform. Brussels, 14th June 2005.

away equity stakes in return for the bailout, which was one of the conditions of getting the loan. This outcome is a warning that subsidizing firms in difficulty is not an easy task.

I analyze R&R aid granted to 79 firms from 10 EU countries during the years 1992-2003. The list of bailed-out firms is fixed and I collect additional information on these firms, which makes it a unique data set. The additional information comes from four sources: decision texts of the Commission, London Economics (2004) report to the Commission, the AMADEUS data base and newspapers. The research objective is to examine if bailouts in the EU have achieved their goals. The goal of a bailout is preventing firm's bankruptcy. A bankruptcy (or exit) is defined as ceasing operations of a firm. If a firm becomes insolvent, sells most of their assets, reduces employment dramatically but stays active in the market, it is also counted as bankrupt.

I study three issues. First, I ask the question: how did the risk of bankruptcy change after the bailout? To provide an answer, I estimate the hazard rate of all R&R aid beneficiaries. The results show that in the first four years after the bailout firms exit at an increasing rate. This indicates that a bankruptcy after the bailout does not occur randomly, but is a result of a wasteful behavior: firms went bankrupt with delay, because they could afford to survive a bit longer with the means granted by the state and possibly other sources. A total of 29.3% of the subsidized firms exit anyway. Predictions from the hazard equation suggest that the Commission could have reduced this failure rate by prohibiting rescue aid in sectors with small externalities for the economy. The required standard of proof in the Commission's bailout approvals should be at least a 70% chance of survival for four years after the bailout.

Second, I find that firms receiving a restructuring subsidy go bankrupt less often than rescue aid receivers. Allocation of these two types of aid to different firms is therefore a tool for discrimination. The results on the choice of subsidy type suggest that state-owned firms receive restructuring aid with higher probability due to governments' preference for public employment. Once I control for public employment, being a state-owned firm becomes a disadvantage in chances for restructuring aid. All state-owned firms which were later privatized and those older than 100 years received exclusively restructuring aid. This special position of state-owned firms is likely to cause soft budget constraints in state-owned enterprizes in Europe. I also find a strong time trend in the data: after the year 2000 rescue aid was more likely than restructuring aid, while the opposite is true for the years up to 2000. As a consequence of this tendency, more firms are granted aid which is less efficient in preventing bankruptcy.

Third, I reject the hypothesis that the subsidy type is exogenous in the hazard estimation. Governments select firms that get more comprehensive restructuring aid and influence the firm's survival chances by this choice. The impact of the endogenous sub-

sidy type on the hazard rate is stronger than in the case of the exogenous subsidy type. Thus, without taking the endogeneity into account, the effect of the subsidy type on the hazard is underestimated.

The literature most relevant for this paper are empirical studies on bankruptcy prediction. Such studies typically use firm-level accounting data to predict duration of Chapter 11 protection in the American bankruptcy law. Shumway (2001) advocates survival analysis as the most appropriate econometric technique to predict bankruptcy. Bandopadhyaya (1994) finds the counterintuitive result that the higher the outstanding interest of the firm, the earlier the firm gets over its difficulties. His explanation is that creditors are more willing to compromise in negotiations when the debt is high. Li (1999) develops a Bayesian approach to hazard estimation. In both papers, the probability of exiting Chapter 11 protection increases during the first two years. My result is opposite: the probability of bankruptcy increases with time during the first four years.

Both R&R aid and Chapter 11 have the same aim: to prevent bankruptcy whenever it is efficient. Couwenberg (2001) estimates that 41% of firms under Chapter 11 protection during the years 1980-1996 restructure successfully and come back to vitality. Looking at *major* cases, however, the success rate is close to 100% (Li, 1999). These numbers are achieved without any transfers from the state to the firms in trouble. For R&R aid during the years 1995-2003, the share of survivors amounts to 70.7%. This outcome suggests that there is scope for improvement in the European bailout policy. The crucial difference between Chapter 11 protection and R&R aid is the incentives they create. Managers avoid Chapter 11 *ex ante*, since the likely outcome of starting bankruptcy proceedings is that creditors will get a part of the equity. In addition, under Chapter 11 protection firms incur legal and opportunity costs. R&R aid, in turn, requires no transfers of equity to creditors. The firm gets a transfer from the taxpayers, which allows it to continue operations. Thus, the incentives of European managers to avoid bankruptcy are not as strong. Therefore, I provide empirical support for the suggestion of Nitsche and Heidhues (2006) that R&R aid should be linked to bankruptcy proceedings, for example by granting aid only to firms that formally file for bankruptcy. Such a condition would have more severe consequences for managers who failed to restructure the firm earlier, since it signals managers' failure to the market. Managers would then have stronger incentives not to ask for aid.

To the best of my knowledge, only two papers evaluating bailout policy exist. Schweiger (2006) investigated the impact of state aid granted to ailing firms on static and dynamic efficiency. In her data set all bailed-out firms survived. However, aid caused an increase of their market shares without changing their total factor productivity at the same time, suggesting that the effect of aid was distortive. Concerning bailouts in the EU the only empirical analysis was done by Chindooroy et al. (2005). Their paper provides summary

statistics about the cases and a discrete choice estimation of survival probability. They find that about 30% of R&R aid beneficiaries went bankrupt, which they attribute to the business cycle. My paper is different from theirs in several ways. Since hazard models give better survival probability estimates (Shumway, 2001), I use the hazard approach.[5] It allows me to compare R&R aid to the Chapter 11 protection, for which the hazard rate estimates exist already. I also analyze governments' bailout policies, which is an entirely new research topic. Finally, I investigate the interdependence between the subsidy choice and bankruptcy.

The paper is organized as follows. The next section describes the legal framework for bailouts in the EU and provides some summary statistics on how the guidelines were applied during the years 1995-2003. Next, I estimate the hazard rate of R&R aid beneficiaries, compare it to Chapter 11 hazard rates and assess the effectiveness of bailouts in preventing bankruptcy. In section 2.4, I empirically examine governments' choices to grant rescue versus restructuring aid and I explore the endogeneity of the subsidy choice in the hazard rate analysis. Finally, I sum up in the last section.

2.2 Rescue and Restructuring state aid in the European state aid control

2.2.1 State aid in the EC Treaty

Article 87 (1) of the EC Treaty[6] provides legal constraints to state aid in the EU. State aid is incompatible with the common market, and therefore in general prohibited, when it fulfils four conditions: it is granted from state resources, distorts or threatens to distort competition, favors certain undertakings, and affects trade between member states. If one of the conditions is not satisfied, state aid law does not apply. For example, European subsidies for farmers are not incompatible, since the selectivity condition is not fulfilled: *all* farmers receive them. If a local ferry between islands of the same country is subsidized, trade between member states is not affected and the European state aid law does not apply. But when the ferry connects two different member states, the aid is incompatible with the common market. Only three types of aid are *per se* considered compatible (Article 87 (2)): social aid granted to individuals which does not discriminate with respect to the origin of the products, aid to remedy natural disasters and aid to compensate economic disadvantages of the the division of the Federal Republic of Germany in the last century.

Article 87 (3) gives the Commission discretion to grant exemptions to state aid prohi-

[5] Jenkins (2004) provides an excellent guide to discrete-time hazard rate estimation.
[6] OJ C 325, 24.12.2002, p.67.

bition in five cases:
a) aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment;
b) aid to promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State;
c) aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest;
d) aid to promote culture and heritage conservation where such aid does not affect trading conditions and competition in the Community to an extent that is contrary to the common interest;
e) such other categories of aid as may be specified by decision of the Council acting by a qualified majority on a proposal from the Commission.[7]

R&R aid is exempted based on cases a) and c).

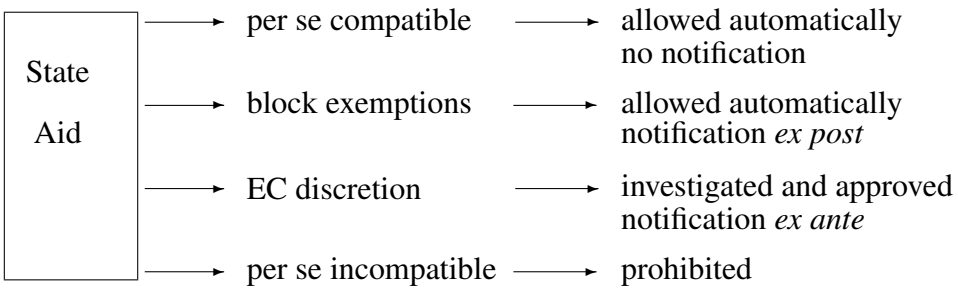
Article 88 makes the European Commission and the member states responsible for the control of the compatibility of all state aid measures in the EU. Governments should notify the Commission about state aid measures they plan to take and they must take the opinion of the Commission about aid compatibility with the common market into account when deciding on the aid. Third parties can submit their comments on government aid. Finally, if illicit aid was granted, the Commission can demand the aid to be altered, abolished or repaid.

Article 89 gives the Council the right to introduce regulations about the implementation of Article 87 and 88, as well as exemptions from the regulations. An important block exemption is a *de minimis* rule, which states that aid not exceeding EUR 200 000 over a continuous period of three years is not considered incompatible with the common market.[8] The rule was introduced to reduce the cost of administrative burden on the Commission created by state aid control and to facilitate subsidies for small and medium enterprizes (SME), which are expected to use low amounts of R&R aid more often. The ceiling amount in the *de minimis* rule is a gross grant or its equivalent. The rule does not apply to transport, shipbuilding, agriculture, fisheries sectors, export-related activities, and aid promoting domestic over imported products. Other block exemptions concern training aid, employment aid and aid for SMEs. The architecture of state aid control is depicted in figure 2.1. The Commission has worked out several documents defining the rules in the state aid control process, depending on the objective and the instrument of aid. So-called horizontal rules include guidelines on various types of aid defined by objective: regional

[7] ibidem.

[8] Official Journal L 379 of 28.12.2006. This regulation, however, does not apply to rescue and restructuring aid.

Figure 2.1: The Commission investigates aid's compatibility with the common market in cases left to its discretion.



aid, aid for research and development (R&D), environmental aid, aid for risk capital and aid for rescuing and restructuring (R&R) firms in difficulty. Sectors like broadcasting, coal, shipbuilding, steel, electricity, postal services, synthetic fibres and motor vehicles have their own sectoral guidelines. Finally, regulations exist about the use of specific aid instruments (e.g. state guarantees, public land sales, export credit insurance and fiscal aid).[9]

2.2.2 Community Guidelines on State Aid for Rescuing and Restructuring Firms in Difficulty

At the Commission's discretion, rescue and restructuring aid for a firm in difficulty may be considered compatible with the common market based on Article 87 (3), points a) and c). Governments may support certain industries or sustain jobs in poor or dependent on one big firm regions in order to facilitate social and regional cohesion. Detailed rules, according to which the Commission decides on such cases, are specified in the *Community Guidelines on State Aid for Rescuing and Restructuring Firms in Difficulty*,[10] described in the remainder of this section.

The guidelines explain the way the European Commission exercises its discretion in the field of bailouts. The guidelines were adopted in 1994, amended in 1999 and 2004, and the current version – on which I focus here – stays in power until October 9, 2009. The general approach of the Commission to R&R aid is that it is the most problematic type of subsidies. R&R aid is directed towards inefficient firms, so it is likely to act directly against competitive forces that drive the firm out of the market. According to the guidelines, R&R subsidies are justified only in three circumstances: by social or regional cohesion considerations, to support small and medium-sized enterprizes, and in presence

[9]Available at the Commission's website `http://ec.europa.eu/comm/competition/state_aid/legislation/legislation.html`, Sept. 27, 2007

[10]OJ C 244, 1.10.2004, p.2.

of a menace of high market concentration. While the first objective is a matter of social judgement, the remaining two are economic issues.

A firm entitled to R&R aid, called a *firm in difficulty*, is "unable, whether through its own resources or with the funds it is able to obtain from its owners/shareholders or creditors, to stem losses which, without outside intervention by the public authorities, will almost certainly condemn it to going out of business in the short or medium term."[11] Such firms typically have "increasing losses, diminishing turnover, growing stock inventories, excess capacity, declining cash flow, mounting debt, rising interest charges and falling or nil net asset value."[12] This includes also firms that filed for insolvency, subsidiaries of firms that are also in difficulty, or subsidiaries, which prove that the state of difficulty is their own responsibility and the parent cannot help. Newly created firms (up to 3 years old) are not eligible for R&R aid. The most important element of the definition is that without the subsidy the firm would exit the market - only a state intervention can keep it in operation.

Bailouts consist of two kinds of subsidies: rescue and restructuring. While a rescue subsidy keeps the firm in operation for the time needed to asses the situation and prepare a plan of further action, restructuring aid is a long-term assistance in the implementation of the restructuring plan, which must aim at restoring firm's viability. Each of rescue and restructuring subsidies can be granted only once every ten years (five in the agricultural sector). This is the so-called *one time – last time principle* and refers to all types of beneficiaries: large firms, groups of firms, firms in assisted areas and SME's. If both aid types are granted, the order also matters: rescue aid should be given before restructuring aid, otherwise the restructuring process failed to restore viability and a firm is not eligible for the rescue subsidy. From the economic point of view, strict application of the one time – last time principle is crucial, since it reduces efficiency distortions caused by soft-budget constraints.

Rescue aid is granted as a loan or a loan guarantee at a market interest rate for a maximum of six months. After that time, a plan of restructuring or a liquidation plan must be presented to the Commission. In principle, there is a maximum amount of rescue aid, which depends on earnings before interest and taxes, depreciation and working capital according to a formula in the appendix to the guidelines, but exceptions are possible.

Restructuring subsidy is granted only to those firms that present a convincing plan of restoring the firm's long-term viability and a market survey. If the market power of the beneficiary is significant, the Commission imposes compensatory measures such as divestiture of assets or reduction in capacity. The beneficiary is expected to make a sig-

[11] ibidem, p.3.
[12] ibidem.

nificant contribution to cover restructuring costs: 25% in case of a small firm, 40% for a medium-sized firm and 50% for a large firm. The implementation of the restructuring plan should be communicated to the Commission by reports at least annually.

Aid for large firms must be notified individually each time, while for SMEs aid schemes are possible. SMEs (with the exception of the agricultural sector) and firms from assisted areas have less strict rules as far as compensatory measures and reporting are concerned. The guidelines do not apply to coal and steel sectors.

2.2.3 Summary statistics

In the time period from 1995 to 2003, the Commission made 86 decisions to approve R&R subsidies granted to 79 firms from 10 EU countries. The first empirical study of the decisions was done by Chindooroy et al. (2005). In this section, I revise summary statistics related to further questions addressed in this paper. A cross-sectional data set is used, with each decision as a unit observation.[13]

The decisions I analyze were made during the years 1995-2003. The starting year is 1995, which is the first year when decisions were based on the guidelines for R&R aid. In some cases, however, the subsidy was notified ex post, hence the year of granting aid was earlier than the decision itself. The last year is 2003, just before the EU enlargement and introduction of the new version of the guidelines. The most aid-intensive period was 1996-1998 with 13-15 subsidies granted each year. After 1998, the number of cases has halved and oscillated around 7 (see table 2.1).

There is a clear tendency of granting more rescue aid in recent years. Before 2001, the number of rescue cases was lower than restructuring aid cases. Starting with 2001, this tendency was reversed. The change in the pattern coincides with the Commission's increased political efforts to limit state aid. For example, the Lisbon Agenda in 2000 encouraged the EU governments to cut state aid for inefficient firms and redirect it to firms with potential for innovation and growth.

Subsidy characteristics

The nature of a rescue subsidy as defined by the guidelines is very different from restructuring aid. While the former can be granted to any firm with an acute problem as a short-term solution, restructuring aid is a long-term assistance with viability as objective. Table 2.2 reveals that differences indeed exist. For each subsidy type, I report the total number of firms receiving such aid, followed by the number of state-owned and private firms, the number of bankrupt and surviving firms, the number of firms sold after the sub-

[13] For the description of the data set construction procedure, see section 2.6.2.

Table 2.1: Number of granted R&R subsidies per year.

Subsidy year	Rescue cases	Restructuring cases	Total
1992	0	1	1
1993	0	1	1
1994	1	5	6
1995	3	5	8
1996	5	8	13
1997	6	9	15
1998	3	11	14
1999	1	5	6
2000	0	2	2
2001	6	2	8
2002	6	2	8
2003	3	1	4
Total	34	52	86

Population: Cross-section of decisions.

sidy and average employment. State-ownership means that the state controls more than 50% of the firm's capital. Bankruptcy and sale are observed in the time period between the subsidy and 2003. Note that ownership status is known only for 69 firms and survival status only for 75 firms (bottom row of table 2.2).

Table 2.2: Summary statistics for rescue and restructuring subsidy types.

Subsidy type	Total	SOE*	Private	Bankrupt	Survived	Sold	Avg. empl
Rescue	27	5	19	13	13	4	3404
Double rescue	1	1	0	1	0	0	1791
Restructure	45	21	17	8	34	18	6333
Double restructure	1	1	0	0	1	0	3508
Rescue and restr.	5	2	3	0	5	1	8730
Total	79	30	39	22	53	23	5340

Population: Cross-section of firms. SOE denotes state-owned enterprize.

The first observation is that there were many more restructuring aid than rescue aid cases. Seven firms received a double subsidy. Five of them were rescue cases followed by restructuring aid, which is the pattern promoted by the guidelines. In the other two cases, the one time -last time principle was clearly violated. Nearly a half of restructuring aid cases concerned state-owned firms, while less than one-fifth of rescue cases involved public firms. In addition, only state-owned firms benefited from the two cases breaking the one time -last time principle. The null hypothesis that ownership and the subsidy type

are independent is rejected based on the Pearson's chi-squared test at 5% significance level.[14] If one agrees that restructuring aid is more attractive to firms in difficulty than rescue aid, then the data suggest that state-owned firms had a favorable treatment.

Turning to the bankruptcy rate, 22 firms went bankrupt, which makes about 30% of all bailed-out firms. The distribution of bankruptcies is biased towards rescues: a half of all rescue aid cases ended up with a bankruptcy, compared with less than a quarter of restructuring aid cases. The null hypothesis that the type of subsidy is independent of bankruptcy is rejected based on the Pearson's test at 2% significance level. The bias towards rescues is natural given the characteristics of rescue aid, which is only temporary and is not meant to support a restructuring process. Restructuring aid, however, should never end up with bankruptcy -its aim is to get the firm back to viability. This aim was not achieved in 8 cases out of 45 total (17.7%).

Regarding the distribution of firms that were sold to a new owner after receiving the subsidy, a higher proportion of restructured firms were sold than the proportion of rescued firms. This suggests that a restructuring subsidy can be used to increase the value of a firm in difficulty before sale, for example before privatization. Out of 28 state-owned firms, 13 were privatized after receiving a restructuring subsidy. In a few cases, privatization was even a condition for R&R aid approval demanded by the Commission. All privatized firms survived.

Finally, looking at average employment, firms with restructuring aid had on average more employees than firms receiving rescue aid. This suggests a too-big-to-fail effect, meaning that bigger firms get more support from the state in case of distress, because their exit would potentially have a larger negative externality on the state-wide or regional economy.

The most common aid instruments were guarantees, loans, capital injections and debt restructuring. Table 2.3 presents frequency of their use.

Table 2.3: Frequency of use of different aid instruments.

Aid instrument	**Number of cases**	**Frequency**
Guarantee	43	50%
Loan	24	27.91%
Capital injection	33	38.37%
Debt restructuring	11	12.79%
Total	86	100%

Population: Cross-section of decisions.

[14] This is still weak evidence of the correlation, since there are few observations and Pearson's chi-squared test uses a limit distribution.

Compensatory measures were used in two rescue aid cases and thirty four restructuring aid cases, thirty six times in total. The most common types of compensatory measure were a reduction of capacity, reduction of workforce and privatization. Table 2.4 presents frequency of their use.

Table 2.4: Frequency of use of compensatory measures.

Compensatory measure	**Number of cases**	**Frequency**
Capacity reduction	27	75%
Workforce reduction	22	61.11%
Privatization	15	41.67%
Total	36	100%

Population: Cross-section of decisions.

Bailout policies in European countries

The EU member states use R&R subsidies in a very differentiated way. Table 2.5 highlights the differences across countries in detail. For each country, I report the total number of subsidized firms, the number of rescue and restructuring subsidy types granted, the number of state-owned and private firms, the number of bankrupt and surviving firms, the number of firms sold after the subsidy, and finally, average employment in subsidized firms.

Table 2.5: Differences in bailout policy across countries.

Country	**Firm #**	**Restr.**	**Rescue**	**SOE**	**Priv.**	**Bankr.**	**Surv.**	**Sold**	**Avg. empl.**
Greece	1	1	0	1	0	0	1	0	7 529
Netherlands	2	1	1	1	1	1	1	1	4 906
Austria	4	3	3	1	3	1	3	1	390
UK	4	2	2	2	2	0	4	2	4 640
France	11	9	3	9	2	0	11	6	19 187
Portugal	4	4	1	1	1	0	3	1	141
Spain	10	8	2	5	5	4	6	2	928
Italy	15	10	6	6	5	6	7	5	5 447
Belgium	4	2	2	1	0	1	2	0	3 037
Germany	24	12	14	3	20	9	15	5	3 774
Total	79	52	34	30	39	22	53	23	5 340

Population: Cross-section of decisions.

Germany leads with 24 bailed-out firms, followed by Italy, France and Spain with 15, 11 and 10 firms respectively. Notably, there are also 5 member states that did not bailout

any firm (not in the table): Denmark, Finland, Ireland, Luxemburg and Sweden. While in case of Luxemburg one can have doubts if this result is because of government's policy or economy size, in the other four cases it looks like a hard no-bailout policy.

A comparison of the policies of Germany and France provides interesting insights. Among 24 Germany's beneficiaries, the majority received rescue aid. Only 3 beneficiaries were state-owned and employment was lower than the total average. In contrast, France used mainly restructuring aid, mainly directed to state-owned firms and had the highest number of sold firms. French bailed-out firms employed four times more people than the total average and none of them went bankrupt. These two policies seem to be the opposites. Germany provides short-term support for smaller private firms, while France uses R&R aid to restructure huge state-owned firms. Italy's and Spain's policy is similar to that of France, but the bankruptcy rates are higher.

Differences in countries' policy can also be found in the distribution of industries, from which the bailed out firms came (I use a 2-digit NACE codes as industry classification, see table 2.15 in the Appendix 2.6.1). The distribution is presented in table 2.6. Some countries grant R&R aid mainly in sectors, where negative externalities of a

Table 2.6: Countries' bailouts per industry.

	Country										
Industry	EL	NL	AT	UK	FR	PT	ES	IT	BE	DE	Total
services	.	.	.	.	2	.	.	2	1	1	6
finance	.	.	.	1	5	.	.	2	.	1	9
transport	1	.	.	2	3	.	.	1	2	2	11
electric water	.	.	.	1	.	.	.	.	.	.	1
trade	.	.	.	.	.	.	1	.	.	1	2
construction	.	.	1	.	.	1	1	6	.	2	11
manufacturing	.	2	3	.	1	3	7	3	1	17	37
mining	.	.	.	.	.	.	1	1	.	.	2
Total	1	2	4	4	11	4	10	15	4	24	79

Population: Cross-section of firms.

bankruptcy may be painful for the whole economy (e.g. UK). Other countries bail out in sectors, where such externalities are less likely to exist (Netherlands, Austria, Portugal, Spain). Finally, there are countries that grant R&R aid economy-wide (Italy, Germany, France). The Pearson's test rejects the hypothesis that the industry and the country of R&R aid receivers are independent.

Characteristics of bailed-out firms

Table 2.7 presents summary statistics about R&R aid beneficiaries. Industries supported

Table 2.7: Time-invariant firm characteristics.

	Total	Bankrupt
Industry		
services	4	1
finance	9	0
transport	11	1
electric & water supply	1	0
trade	2	0
construction	10	6
manufacturing	36	12
mining	2	2
Total	75	22
Ownership		
private	38	13
state-owned	30	7
Total	68	20
For sale		
unchanged	50	21
new owner	23	0
Total	73	21

Population: Cross-section of firms.

by R&R aid are state-wide infrastructure providers in transport, electricity/water supply and banking, but also manufacturing and construction sectors, trade, and services. A striking observation is that nearly half of all cases involved the manufacturing industry, a third of which went bankrupt after receiving the aid. A high share went also to the construction sector, where bankruptcies were more common: 6 out of 10 firms left the market. There were no bankruptcies in the financial, trade and electricity and water supply sectors. Regarding the ownership distribution, the share of state-owned firms is very large relative to the share of state-owned firms in the total EU economy, but the majority of beneficiaries are still private. State-owned firms tend to go bankrupt less often than private ones. All firms which were sold after the subsidy survived.

Table 2.8 reports summary statistics on age and employment. Age is defined as the number of years passed between incorporation and the subsidy. R&R beneficiaries are 58 years old on average. There is one firm that was only 1 year old when it was subsidized, which is against the rules of the guidelines, since firms younger than 4 years cannot be bailed out. There is also one 457 years old firm. Average employment is the average

Table 2.8: Time-varying firm characteristics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Age (years)	66	58	69.3	1	457
Average employment	75	5 340	11 768	36	69 671

Population: Cross-section of firms.

number of people employed in the period between the bailout and the year 2003.[15] It reached 5340, indicating that bailed-out firms were on average large.

Summary

The summary statistics highlight two typical problems with R&R aid: high mortality rate and a strong influence of political economy issues. Bankruptcy rate amounts to about 30% of all beneficiaries and 17% of restructuring aid beneficiaries. Such a high bankruptcy rate suggests possible shortcomings in the Commission's decision-making process, since bailouts of firms with bad prospects for survival should not have been approved. The political economy of R&R aid involves at least three issues. State-owned firms are over-represented and they get more restructuring aid than private firms. Governments' bailout policies are very heterogenous across countries and vary from a hard no-bailout approach to frequently given support to firms from various industries. Finally, several cases contradict the *one time - last time* principle, indicating that the guidelines were not the only criterion of the Commission when approving the subsidy.

I address these issues in the next sections. In section 2.3, I evaluate bailouts in terms of their effectiveness in preventing exit and in section 2.4, I analyze member states' bailout policies.

2.3 Exit patterns for bailed-out firms

The objective of a bailout is to prevent beneficiary's almost certain exit. Exit patterns are therefore an important information for the assessment of bailouts' effectiveness: exit implies that the bailout has failed. A concept designed to examine exit is a hazard rate, which relates the probability of exit in a given year to the time passed since the bailout and firms' characteristics. Assuming that R&R aid prevents exit, the hazard rate for bailed-out firms should be low and decreasing in time. Another reason to estimate the hazard rate of R&R aid beneficiaries is to compare it to the existing hazard rate estimates for

[15] I use average employment to proxy for the size of the firms. Due to numerous missing data for this variable, I cannot use employment in the subsidy year.

firms protected by Chapter 11 of the Bankruptcy Act in the US (Bandopadhyaya, 1994; Li, 1998). Both institutions aim at exit prevention, so a comparison of their effectiveness could provide interesting insights.

To the best of my knowledge, the hazard rate for R&R beneficiaries has never been estimated. The first empirical study on R&R aid, Chindooroy et al. (2005), provides estimates for a time-invariant probability of survival. Their results show that rescue subsidy beneficiaries have a lower survival chance than firms getting a restructuring subsidy, and firms which got subsidies after the year 1999 had higher survival chances. As an estimation method they use a one-period discrete choice model. However, according to Shumway (2001) and the following literature, discrete choice models with cross-sectional data give biased and inconsistent estimates of the probability of survival. This is because one-period models do not take into account time changes in the proportion of surviving subjects: if a firm went bankrupt, it is denoted as bankrupt no matter how long it lived after the subsidy. Censored observations, on the other hand, meaning firms which survive until the end of the observation period, are counted as survivors for ever, although it cannot be excluded that they go bankrupt later. This is particularly important for my data, since I have a significant number of censored observations.

The drawbacks of discrete choice models are resolved by the hazard rate approach. Hazard rate is defined as instantaneous probability of an event (e.g. bankruptcy) at a time point. The main characteristic of hazard models is that they define event's risk at each point in time. This allows to code bankrupt and censored firms correctly as active or not at a certain point in time. In addition, time-varying variables and hence more information can be utilized.

Two estimation methods will be applied: a non-parametric and a parametric one. In the estimation I use an unbalanced panel data set.[16] I examine 75 R&R aid beneficiaries for which the surviving status in the year 2003 in known. The time unit is a calendar year. It starts being counted from the year when the subsidy was given and it stops in the year of bankruptcy or in 2003, if the firm survived until then (these are the censored observations, which receive a special treatment in the methodology I will use). Descriptive statistics of survival data are reported in table 2.9. Roughly one fourth of all observations comes from bankrupt firms. Average survival time for bankrupt firms is shorter than for censored firms by 1.8 years.

2.3.1 Non-parametric estimation of exit patterns

Non-parametric estimates of the hazard rate are also called life-tables, as they were invented to analyze the life length for the population in the United Kingdom and became

[16] For details, see the Appendix 2.6.2.

Table 2.9: Description of survival data.

No. of observations	
Total	409
Bankrupt	92
Censored	317
Average survival (years)	
Total	5.45
Bankrupt	4.18
Censored	5.98

Population: Panel.

later the cornerstone of modern demography.[17]

The data is arranged in the following way: the calendar year when the subsidy was granted is counted as year number 1, the following year gets the number 2 and so on, until the bankruptcy or 2003, the last year of the observation period. For each year j, the number of firms entering this year is calculated (N_j), the number of firms bankrupt in that year (b_j), the number of surviving firms for which j is the last year of observation (censored, c_j). [18]

The discrete hazard rate in year j is the probability of going bankrupt during the year j, conditional on surviving until the beginning of that year. The estimate is simply

$$h_j = \frac{b_j}{N_j}, \tag{2.1}$$

that is the number of aid beneficiaries going bankrupt in year j divided by the number of surviving until year j. The standard error:

$$s_{h_j} = \frac{h_j}{\sqrt{b_j}}. \tag{2.2}$$

For the years, when the number of bankruptcies is zero, standard errors cannot be calculated. The results are presented in table 2.10. The first row can be read as follows: during the year when they received the subsidy, 4 firms out of 75 went bankrupt. Another 4 firms went out of the sample, which means that they were subsidized in 2003 and survived that year. The probability of going bankrupt in the first year after the subsidy is 0.0533 with the standard error of 0.0267.

The highest number of bankruptcies took place in the fourth year after the subsidy and

[17] John Graunt, "Natural and Political Observations Made upon the Bills of Mortality", London, 1662.

[18] All censored firms are observed until the end of the year, so actuarial adjustment is not used. Estimations are done with STATA 9.

Table 2.10: Life-table estimates.

Year j	Beg. Total N_j	Bankruptcies b_j	Lost c_j	Hazard h_j	St. Error s_{h_j}
1	75	4	4	0.0533	0.0267
2	67	2	5	0.0299	0.0211
3	60	4	6	0.0667	0.0333
4	50	6	1	0.1200	0.0490
5	43	1	3	0.0233	0.0233
6	39	0	8	0.0000	.
7	31	1	9	0.0323	0.0323
8	21	2	7	0.0952	0.0673
9	12	0	4	0.0000	.
10	8	2	4	0.2500	0.1767
11	2	0	1	0.0000	.
12	1	0	1	0.0000	.

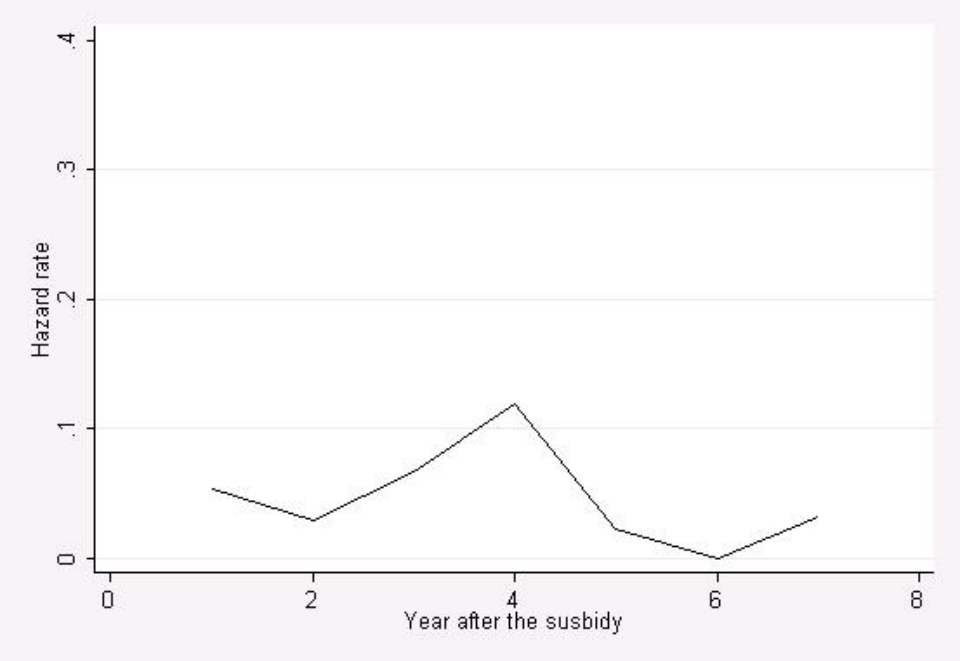
Population: Panel.

it remained low after that (column 3). This suggests that the first four years are crucial in making a successful bailout. The last bankruptcies occur 10 years after the subsidy. The lost cases (column 4) are the censored observations ending in a given period. For example, in the seventh year the number of lost cases reaches nine, meaning that nine firms that were subsidized seven years before 2003 survived. Standard errors increase with time (column 6), since the sample gets smaller and smaller. After the eighth year, the number of observations drops below 20. In the tenth year two bankruptcies take place, but they are given too much weight due to the low sample size. For this reason, I only consider estimates until the eighth year.

The estimate of the hazard function is depicted in figure 2.2. The shape of the empirical hazard function shows the exit patterns of the R&R aid beneficiaries. During the first year the hazard decreases a little, reflecting the fact that some firms decide to liquidate immediately. Then the hazard increases and reaches the peak of 12% in the fourth year, meaning that during the first four years more and more firms exit. Only after the fourth year, the hazard drops to low levels.

Such a pattern suggests that R&R aid delays exit. Without the bailout firms would exit in the first year, but thanks to the subsidy they live for up to four years longer and exit later. The scale of this phenomenon is not negligible: 16 out of 75 firms went bankrupt within four years after receiving an R&R subsidy.

Figure 2.2: Empirical hazard function.



2.3.2 Parametric hazard rate estimation

More detailed insights and predictions are possible with the parametric estimation of the hazard rate, however at the expense of functional and parametric assumptions.

Methodology

The data is discrete in time: instead of precise dates, only the years of subsidies and the bankruptcies are registered. In theory, however, firms may go bankrupt on any working day of the year, so the underlying true hazard is continuous. Such data needs a special model, which takes their nature into account. Denote the probability that a firm survives until the end of year j by $S(j,X_j)$, where X_j is a vector of firm's characteristics in year j. Denote the true continuous hazard rate for a firm with characteristics X_t by $\theta(t,X_t)$ and the the end of year j by j_1. The survivor function $S(j,X_j)$ can then be expressed as[19]

$$S(j,X_j) = \exp(-\int_0^{j_1} \theta(u,X)du). \tag{2.3}$$

Now I assume that the continuous hazard rate satisfies the proportionality assumption

$$\theta(t,X) = \theta_0(t)\exp(\beta^T X). \tag{2.4}$$

[19]For the details on the basic relationships between survival and hazard functions, see the Appendix 2.6.3 or Jenkins (2004).

This assumption means that firms with different values of the product $\beta^T X_j$ have proportional hazard rates, because the time-dependent part θ_0 (called the baseline hazard) is common for all firms. Substituting (2.4) into (2.3), the final formula for the survival probability is

$$S(j,X_j) = \exp(-H(j)\exp(\beta' X_j)), \tag{2.5}$$

with $H_j = \int_0^{j_1} \theta_0(u)du$.

The discrete hazard rate is the probability of exit during the year j, conditional on surviving until year j, which can be written down as

$$h(j,X_j) = \frac{S(j,X_j) - S(j-1,X_j)}{S(j-1,X_j)} = 1 - \frac{S(j,X_j)}{S(j-1,X_j)}. \tag{2.6}$$

Substituting the expression for the continuous survival probability (2.5) into the discrete hazard rate (2.6) and manipulating the formula I get the equation to estimate:

$$h(j,X_j) = 1 - \exp[-\exp(\beta' X_j + \gamma_j)], \tag{2.7}$$

which describes the probability of bankruptcy in period j as a complementary log-logistic function (or *cloglog*) of the firm-specific vector X_j and a function of time $\gamma_j = \log(H(j) - H(j-1))$. Note that the two variables are additively separated, which makes the equation easy to estimate. In statistics, cloglog function is defined as $g(x) = 1 - \exp[-\exp(x)]$ and it is a discrete analog of the log-logistic hazard function. It is particularly suitable for data with few nonzero outcomes due to the asymmetry of its tails: the right tail converges to one more quickly than the left tail converges to zero, so that the positive values are given more weight (Buckley and Westerland, 2004).

Implementation

To estimate the equation (2.7), variables representing $h(j,X_j)$, X_j and γ_j are needed. I choose them in the following way. The dependent variable is an indicator of the bankruptcy of firm i in year j:

$$\text{BANKR}_{ij} = \begin{cases} 1 & \text{if firm } i \text{ went bankrupt in year } j, \\ 0 & \text{otherwise.} \end{cases} \tag{2.8}$$

As the subject characteristics X_j, subsidy type, firm's age since incorporation, state ownership, employment and industry are considered.

Subsidy type is included to estimate the difference in effectiveness between rescue

and restructuring aid. It is a dummy variable

$$\text{TYPE}_i = \begin{cases} 0 & \text{if firm } i \text{ got only a rescue subsidy,} \\ 1 & \text{if firm } i \text{ got a restructuring subsidy.} \end{cases} \tag{2.9}$$

According to this definition, TYPE equals one also in all cases, where both a rescue and a restructuring subsidy and in the case of two restructuring subsidies granted to one firm. I expect the coefficient to be negative, since restructuring aid should ensure lower bankruptcy probability of the beneficiary than rescue aid. Potentially, this variable might be endogenous. The subsidy type, which is chosen by the government, could be correlated with the error term from the equation. For example, a firm which is a monopolist (like a state-wide railway) has a very strong bargaining power, which can have influence on both the subsidy type and the hazard. But in my data set I do not have information on the bargaining power of aid receivers, so this correlation is captured by the error term and creates an endogeneity problem. As a consequence, the estimates might be biased. I deal with this problem explicitly by modelling the government's choice and applying a simultaneous estimation in section 4, but for now it remains a problem to keep in mind when interpreting the hazard estimates.

Variable LNAGE is the natural logarithm of years from incorporation to the subsidy year. I expect the coefficient of this variable to be negative, reflecting the fact that a longer market presence gives know-how which decreases the bankruptcy probability.

A variable of particular interest is firm's ownership PUBLIC_i, equal to one if the state has a majority stake in firm i. If public firms are less efficient than private firms, the estimated coefficient of this variable should be positive. On the other hand, if public ownership is of an advantage in financial distress due to lobbying or high bargaining power, the coefficient will be negative.

The size of a firm is represented by a logarithm of its average employment. I expect the coefficients to be negative - if bailouts prevent job cuts, they should work out especially in case of big firms. In a few specifications, public employment is separated from private employment by using two variables: SIZEPUBLIC_i and SIZEPRIVATE_i. Since the data on employment has many missing points, the average number from all available during the years 1992-2003 is used and is constant over in the panel.

Bankruptcy literature suggests that sector characteristics are significant determinants of survival (e.g. Shumway (2001)). Business cycles also differ across sectors. I therefore add dummies for industries, in which firms were active: INFRASTR for electricity, transportation and financial services, SERVICE for services and trade and MINMAN for mining and manufacturing. Construction sector is left out as a reference category.

Finally, a function of time needs to be estimated (γ_j from equation (2.7)) to capture

duration dependence. Since the empirical hazard rate as depicted in figure 2.2 does not have any typical shape, I choose to specify the baseline hazard in a non-parametric way: I create dummies for each survived after the subsidy year. There are four years, in which no bankruptcies were observed (6, 9, 11 and 12), and for these years the hazard cannot be calculated. As survival literature recommends, I drop observations from these years and the total number of observations decreases to 355. When predicting the hazard for those years, I assume that it is the same as in the preceding year.

The equation to estimate is thus:

$$\begin{aligned} P(\text{BANKR}_{ij}=1) =& g(\beta_1 \text{TYPE}_i + \beta_2 \text{LNAGE}_{ij} + \beta_3 \text{PUBLIC}_i + \\ &+ \beta_4 \text{SIZEPUBLIC}_i + \beta_5 \text{SIZEPRIVATE}_i + \beta_6 \text{INFRASTR}_i \\ &+ \beta_7 \text{SERVICE}_i + \beta_8 \text{MINMAN}_i + \sum_{j=1}^{j=8} \beta_{9j}\gamma_j), \end{aligned} \tag{2.10}$$

where $g(x) = 1 - \exp[-\exp(x)]$ is the complementary log-logistic function, j is a year index and i is a firm index. I estimate three models with different variable sets, since for a few firms data on PUBLIC, LNAGE and employment is missing and adding these variables to the regression reduces the number of observations. In the third model, which includes public ownership, infrastructure dummy is dropped, because in the reduced panel it becomes a perfect predictor for survival. Standard errors were adjusted for within-firms correlation. Marginal effects were calculated for the average value of each variable.

The estimation method is conditional maximum likelihood. Apart from its doubtless advantages like consistency and asymptotic efficiency, it allows to account for censoring very easily. Suppose a subject i went bankrupt in year j and $T(j)$ is a bankruptcy indicator for period j. The likelihood contribution of such a (non-censored) observation i is $P(T_i = j)$. For a censored observation i that survives beyond the last time period j, the likelihood contribution simply is $P(T_i > j) = S_i(j, X_i)$. In this way, information from the censored observations can be correctly extracted in the estimation.

Results

Marginal effects are presented in table 2.11. The first part of the table shows the effects of firm characteristics on the hazard in every year after the subsidy. As expected, the marginal effect for TYPE is significant and negative. *Ceteris paribus*, firms receiving a restructuring subsidy face the probability of bankruptcy about 10% lower than firms with only rescue aid. Restructuring aid is indeed more effective in preventing exit of firms in trouble. Several reasons may be responsible for this finding. Restructuring aid provides firms with more public funds, it assists them for a longer time-period, and it forces firms to

Table 2.11: Estimates of marginal effects in hazard equation.

Dependent variable: bankruptcy

Variable	**Model 1**	**Model 2**	**Model 3**
Subsidy and firm characteristics			
Subsidy type	-0.100**	-0.099**	-0.096***
	(0.028)	(0.033)	(0.007)
lnage		-0.000	0.002
		(0.935)	(0.747)
public			0.141
			(0.519)
sizepublic			-0.006
			(0.537)
sizeprivate			0.011
			(0.263)
infrastr	-0.044***	-0.040**	
	(0.005)	(0.019)	
service	-0.018	-0.012	0.042
	(0.110)	(0.389)	(0.467)
minman	-0.013	-0.008	0.021
	(0.344)	(0.590)	(0.253)
Baseline hazard dummies			
γ_1	-0.026**	-0.031**	-0.092**
	(0.015)	(0.029)	(0.046)
γ_2	-0.032**	-0.033*	-0.081*
	(0.017)	(0.060)	(0.055)
γ_3	-0.018	-0.024	-0.065**
	(0.103)	(0.128)	(0.048)
γ_4	-0.004	-0.010	-0.050**
	(0.792)	(0.569)	(0.025)
γ_5	-0.027**	-0.029*	-0.056**
	(0.034)	(0.068)	(0.012)
γ_7	-0.024**	-0.025**	-0.047***
	(0.023)	(0.036)	(0.003)
γ_8	-0.007	-0.010	-0.038***
	(0.546)	(0.531)	(0.004)
γ_{10}	0.057	0.043	-0.030***
	(0.347)	(0.456)	(0.007)
N	355	321	297
Nonzero outcomes	22	19	18
chi2	163.613	142.823	157.450
p	0.000	0.000	0.000

Population: Panel. P-values in parenthesis.
***(**,*) denotes significance with 1% (5%, 10%) level in a two-tailed Wald test.

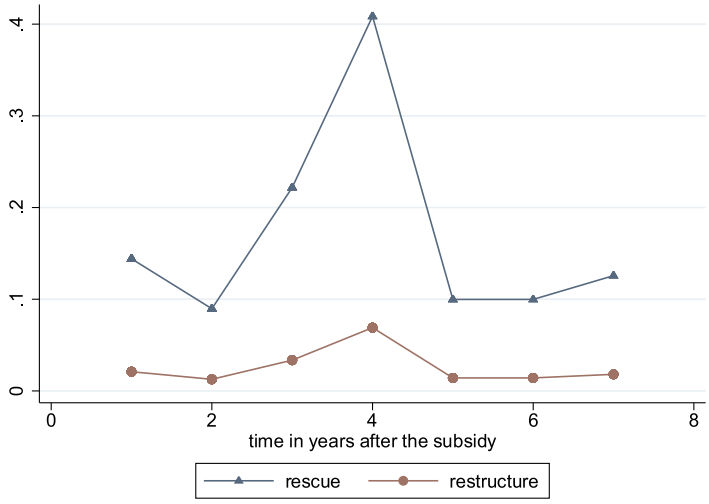
introduce restructuring measures aimed at recovering vitality. The result is consistent with the estimate of Chindooroy et al. (2005), who find that firms with rescue aid have lower survival probability than restructuring aid receivers. Still, the effect might be biased due to the potential endogeneity. If firms receiving restructuring aid are different than firms receiving rescue aid, the difference in the hazard might be driven by firm types rather than aid types. This issue will be addressed in section 4.

Another significant marginal effect exists for firms from the infrastructure sectors (transportation, electricity production and distribution, financial services), which have a lower hazard rate than the reference group – the construction sector. Holding everything else constant, these firms went bankrupt 4% less often. The most likely reason for this result is that a bankruptcy of a firm from infrastructure sectors creates a negative externality on the whole economy. Suppose a large bank goes bankrupt. Households, businesses and governments lose their deposits, payments are disrupt, other banks working with the bankrupt bank get in trouble. As a consequence, not only the bank but also a large portion of the economic activity in the country is affected. Similar situations are likely to take place if a state-wide railway tracks operator or electricity distributor exits. The government may then find it optimal to bail out such firms to avoid the externality of the bankruptcy on the rest of the economy. This phenomenon is known as the "too big to fail" doctrine (Hughes and Mester, 1993; Kaufman, 2003).

The other firm-specific variables have no impact on the hazard. Marginal effects for LNAGE are close to zero and highly insignificant. This is in line with the results in the bankruptcy prediction literature (Shumway, 2001). Public ownership has a positive but insignificant marginal effect. Employment does not matter as well, in line with the estimates of Chindooroy et al. (2005).

The second part of table 2.11 presents results on the duration dependence. A dummy γ_j picks up the impact of the jth year after the subsidy on the hazard. In the third specification all marginal effects are significant, in the first two specifications four out of ten. For their interpretation, differences in their absolute values matter. A plot of the hazard rates predicted from the model 1 for firms in the manufacturing sector which received rescue or restructure subsidy is presented in figure 2.3. The predicted hazard has a small drop after the first year (not present in model 3), indicating that there are some firms, which exit immediately after receiving the subsidy. These firms do not even try to restructure and thereby do not live on the means provided by the subsidy. From the second to the fourth year the hazard is increasing: more and more firms exit. In the fourth year rescue aid beneficiaries exit at a high 40% rate. After the fourth year, the hazard drops and stays at a lower level. The pattern is the same as in the non-parametric model and suggests exit delay (called also "cash-and-carry" effect): firms cash the subsidy and enjoy it for some

Figure 2.3: Predicted hazard functions for the first 7 years.



years before they eventually exit. The reason for exit can be twofold: either the firms do not want to restructure or they are not able to do it. In both cases, however, the subsidy failed to achieve its objective.

Robustness

The results on duration dependence are consistent with the non-parametric hazard estimates. To check consistency with the results of Chindooroy et al. (2005), I estimate a simple probit with one observation per subsidized firm. The dependent variable is a dummy equal to one for bankrupt firms and zero for surviving firms. Instead of the baseline hazard dummies, I use a dummy RECENT equal to one for subsidies after 2000. The two main findings of Chindooroy et al. (2005) can be replicated also in my data set. Firms with rescue aid have lower survival chances than those with restructuring aid and firms subsidized after the year 2000 have a higher survival probability.

The firms receiving a double subsidy are not a regular case in the data set (only 7 firms). Still, dropping all observations for these firms and estimating all three models did not change the estimates dramatically. The only important difference is that industry dummies become significant at 10% level in the specification 1.

2.3.3 Policy implications

Comparison with Chapter 11 protection

The objective of R&R aid is to give a chance for restructuring and avoiding liquidation to firms which otherwise almost certainly exit. The same objective is given to the so-

called Chapter 11 protection by the Bankruptcy Act in the United States, passed in 1978. However, Chapter 11 involves no transfers from the state budget. Instead, it provides businesses in distress with protection against their creditors. The negotiations between the firm in trouble and its creditors take place in a bankruptcy court. As a result, the debt is often reduced and some of the firm's assets are transferred to the creditors.

Duration of Chapter 11 protection was investigated in several studies. The analyzed spell is the time between filing for protection and the exit from Chapter 11 protection, which means return to vitality in nearly all cases (Li, 1998). Li (1999) applies a log-logistic hazard model with Bayesian analysis on a sample of 83 major firms filing for protection in the years 1980-1994, 79 of which exit the protection before August 1994. His results show that bigger firms, with lower firm value, and running legal disputes stay longer under Chapter 11 protection. His estimated hazard function has an inverted U-shape, it grows during the first 21 months and then decreases to zero. Bandopadhyaya (1994) in contrast uses the Weibull distribution specification with the sample of 74 firms in trouble from the years 1979-1990, 43 of which emerged after Chapter 11 protection as a viable business. The results suggest that the higher outstanding interest in the firm and the higher capacity utilization in the industry, the shorter time spent under Chapter 11 protection. The estimated probability of leaving Chapter 11 as a vital business increases with time.

For R&R subsidies the duration dynamics is opposite: exit probability increases in the first four years. A possible interpretation of this fact is that compared with Chapter 11, R&R aid is less effective in achieving its objective. The most likely reason for this difference is the difference in the incentives that the two programs create. Chapter 11 protection is costly to the firm in trouble by the cost of legal services, by the cost of lost clients and contracts that look for a more stable business partner and by the lost equity which creditors get in return for canceling some unpaid credits. Therefore, firms have incentives to quickly drop out of the protection program. In contrast, it is not costly for firms in trouble to take part in a state subsidy program. The aid beneficiaries get the aid and do not pay for it with equity. In this way, incentives to apply for aid are created also for those firms, which could survive without it, or those, which have no chance to survive in the long term.

The way out of this problem could be to introduce a link between bankruptcy law and R&R aid. A suggestion along these lines was made by Nitsche and Heidhues (2006), who recommend that the Commission should approve R&R aid only to firms formally insolvent. Their main concern is the distortion of the dynamic incentives caused by aid and the fact that aid mainly supports creditors and current, trouble-making managers of firms in distress. Opening a formal bankruptcy proceeding is usually a strong signal that

the firm's managers have failed. If it was required for the R&R aid beneficiaries to file for bankruptcy, it could potentially harden the soft-budget constraints problem, because the managers will have stronger incentives to restructure the firm earlier. Importantly, such a solution is relatively easy to introduce.

A related problem is that European bankruptcy law is not uniform across member states and varies in fundamental principles. La Porta and de Silanes (1998) estimate that the French bankruptcy law gives practically no rights to creditors when a distressed firm is reorganized. In contrast, in the UK creditors actively participate in restructuring. These differences are reflected in the data. Couwenberg (2001) calculated the ratios of the number of firms with restructuring plans confirmed by the bankruptcy courts to the total number of bankrupt firms for four countries in the 1990s. The ratio is the highest for the U.S. (11.48%), much lower for France (2.6%) and the U.K. (2.1%) and the lowest for Germany (0.128%).

A source of bias here might be sample selection problems, which I do not control for due to unavailability of the data. I have information on all R&R aid cases, while the two cited Chapter 11 studies take only *major* bankruptcies into account, leaving many small bankruptcies out of the sample.[20] On the other hand, the aid amount in R&R cases is higher than the *de minimis* threshold, so they are also major cases.

European bailout control

European bailout control has been a subject of intense debate in the last years. In 2004 the guidelines were revised in order to introduce a somewhat stricter approach: the maximal amount and the time limit for rescue aid were defined, compulsory shares of firm's contributions to the restructuring costs introduced, etc.[21] By 2009, the next revision of the guidelines is planned. Assessment of bailouts control is also a part of the State Aid Action Plan announced by the Commissioner Neelie Kroes.[22] For this discussion, a better understanding of weaknesses in the past European bailout control is crucial. The hazard model estimated in this section can be used for this purpose.

All bailouts in the data set were granted by the European governments and accepted by the Commission as compatible with the common market. A compatible bailout should have high chances for survival. Therefore, the Commission's performance can be assessed by counting how many times the Commission approved a bailout which had low

[20] During the years 2001-2004, the average number of filings for Chapter 11 protection in the US reached 10 675 (from 3.12.2004 News Release, Administrative Office of the U.S. Courts).

[21] See Nicolaides and Kekelekis (2005) for a detailed overview of the changes.

[22] *Reforming Europe's State Aid Regime: An Action Plan for Change*, speech by Neelie Kroes, who is a Member of the European Commission in charge of Competition Policy, during the Wilmer Cutler Pickering Hale and Dorr and the University of Leiden joint conference on European State Aid Reform. Brussels, 14th June 2005.

probability of survival. This is the so-called type II error in the decision process: a failure to prohibit a non-compatible aid.[23] Using the probability predictions from the hazard rate model, I show that if the Commission were tougher in the aid control process and prohibited aid more often, a number of bailout failures could be avoided.

Since the first four years show the highest mortality, it makes sense to measure success or failure of a bailout by the probability of surviving at least the first four years. I predict this probability for every firm in the data set (specification 1 from table 2.11 is used) and count the number of firms for which the predicted probability is lower than a given threshold. Out of these firms, I count the number of firms, which went bankrupt ex post. Table 2.12 presents the results.

Table 2.12: European bailout control.

Policy goal	Approved bailouts missing the goal	
prob. of surviving > 4	Total	Failed ex post
90%	43	13
80%	17	9
70%	8	6
50%	7	5

The policy goal is the required minimal probability of survival for at least 4 years. Using the most loose policy goal of 50% gives 7 (from the total 86) subsidy approvals, which should not have been granted. In that case, 5 ex post bankrupt beneficiaries would not have been supported, although the remaining two ex post survivors would not have been subsidized as well. In the case of the most strict approach requiring 90% survival probability, every second bailout should not have been approved. That would allow to avoid 13 subsidies to firms exiting later. The best policy goal seems to be 70%: prohibition of these 8 bailouts would allow to avoid subsidizing 6 ex post bankrupt firms, leaving at the same time 2 ex post surviving firms without help.

To sum up, the decision-making process in the European bailout control shows significant shortcomings. Its effectiveness in terms of helping the firms in trouble to survive could be improved by eliminating cases with too low survival probability. In the assessment of this probability, firms should be required to survive at least four years. My estimates suggest that the most likely to go bankrupt are beneficiaries of rescue aid from sectors other than infrastructure providers (transportation, banking, electricity and water distribution).

[23] Prohibition of compatible aid (type I error) does not exist in my data set, since the Commission usually does not prohibit notified aid cases.

2.4 Industrial policy: how governments bail out

One of the results so far is that the subsidy type is an important bankruptcy determinant. Firms receiving rescue aid have lower survival chances than firms with restructuring aid. It is, however, not clear whether this effect is due to better effectiveness of restructuring aid vs. rescue aid or due to the fact that restructuring aid was given to a particular type of firms, e.g. firms in a better shape. This problem will be addressed in this section. First, the determinants of governments' decisions to grant rescue vs. restructuring subsidy are identified. Having done this, the unbiased effect of the restructuring aid type on the hazard is estimated.

2.4.1 Industrial policy

When governments decide to bail out a firm in difficulty, they choose one of the two types of R&R subsidies: rescue aid, which is limited in time, amount and form, and restructuring aid, which is long-term, can be granted in any form and is high enough to facilitate the restructuring process. Therefore, a firm receiving restructuring aid gets substantially more support from the state than a firm receiving only rescue aid.

The choice of the subsidy type is an outcome of the government's bailout policy. I identify determinants of this policy by estimating a discrete choice model with the dependent variable TYPE_i as defined by (2.9). When TYPE_i equals zero, the government gives firm i a rescue subsidy for six months. During this time the firm decides about its future: liquidates or plans restructuring. When TYPE_i equals one, the government engages in the firm much more by participating in the cost of the restructuring process. This choice reveals government's industrial policy preferences: certain firms get more public funds than other firms.

I estimate a probit model

$$Pr(\text{TYPE}_i = 1) = \Phi(\beta' X_i), \tag{2.11}$$

where $i = 1, ..., 79$ is a firm index, Φ is a c.d.f. of a standard normal distribution and X is a vector of exogenous explanatory variables. Several explanatory variables are considered, each representing a theoretical argument for a particular government's choice.

The literature on soft-budget constraints suggests that state-owned firms get more state support than private firms. The reason for this is the lack of separation between ownership and control rights (Lin et al., 1998). An owner and creditor in one body has not enough commitment to provide sufficient incentives for managers. Another argument is related to the fact that state-owned firms often provide social goods in addition to goods they

produce (e.g. kindergartens, pensions, housing, medical benefits). Costs of social good production are covered directly by the state. Röller and Zhang (2005) show that firms have incentives to become less efficient in the private good market in order to extract more money from the state. Public firms are also likely to be more efficient in lobbying the government than private firms. To measure the impact of public ownership on governments' bailout decisions, I add the dummy variable PUBLIC_i to the regression (2.11). The coefficient is expected to be positive.

The number of employees in the firm in trouble should also matter for a government considering a bailout. A bankruptcy of a big firm would result in a high social cost of many unemployed workers. Big firms are also more likely to have unions, so that their workers are a stronger partner to negotiate with. For these reasons, the effect of employment size on the probability of getting restructuring aid vs. rescue aid is expected to be positive. From the government's point of view, however, there are big differences between public and private employment. For political economy reasons, governments might be interested in supporting public employment more than private employment. Frey and Pommerehne (1982) suggest that public employees have a higher participation rate in elections than the rest of the electorate and they support higher public expenditures. I use the variables SIZEPUBLIC_i and SIZEPRIVATE_i to distinguish between these two types of employment. While both positive, I expect the coefficient of private employment to be lower than the coefficient of public employment.

Benefits and costs of a bailout can vary dramatically across different sectors. A benefit of avoiding a bank bankruptcy is greater than in the case of a radio producer, even when both have the equal number of employees and the same ownership structure. The reason is that different type and size of externalities take place in different industries. In banking, not only bank employees lose the jobs, but also all businesses and individuals who had their accounts in the bank experience liquidity problems. An exit of a monopolist railway or an electricity distributor puts the whole economy into a danger of missing supply of their services. To capture such industry effects in the bailout policy equation, industry dummies are included. The variable INFRASTR_i equals one if firm i is active in electricity, transport or financial services sector. A dummy for mining and manufacturing MINMAN_i and a dummy for trade and services SERVICE_i are also included. Construction sector is left out as a reference category.

To allow for cross-country differences in the bailout policy, dummies for five countries with the highest number of bailouts are added: Germany, Italy, France, Spain and Austria.

Table 2.1 indicated that in the year 2001 there was a flip in the proportions of rescue versus restructuring cases in the total subsidy number. This was most likely caused by political pressure at the European level to limit R&R aid. I include a variable RECENT

equal 1 for subsidies granted in years 2001-2003 and 0 otherwise to account for possible time effects. I expect its estimated coefficient to be negative.

Marginal effects calculated for the average value of each variable are reported in table 2.13. Only 65 firms are used in the estimation, due to the fact that for the remaining 14 firms data on variables PUBLIC or employment size are missing. Two model specifications are presented: model 1 includes a total employment variable, while model 2 distinguishes between private and public employment.

Table 2.13: Estimates of marginal effects in industrial policy equation.

Dependent variable: SUBSIDY TYPE

Variable	**Model 1**	p-values	**Model 2**	p-values
Firm characteristics				
recent	-0.685***	0.000	-0.685***	0.000
public	0.291*	0.057	-0.781*	0.060
employment	-0.015	0.769		
sizeprivate			-0.091	0.205
sizepublic			0.081	0.329
Industry and country effects				
infrastr	0.218	0.377	0.123	0.679
service	0.138	0.644	-0.007	0.986
minman	-0.078	0.718	-0.211	0.362
Germany	-0.029	0.906	-0.120	0.653
Italy	-0.358	0.204	-0.515**	0.042
France	-0.305	0.372	-0.463	0.138
Spain	0.050	0.851	0.014	0.962
Austria	-0.021	0.954	-0.149	0.700
N	65		65	
pseudo-R2	0.277		0.307	
log-likelihood	-30.936		-29.667	
chi2	23.739		26.277	
p	0.014		0.010	

Population: Cross-section. ***(**,*) denotes significance with 1% (5%, 10%) level in a two-tailed Wald test.

The most significant marginal effect of -68.5% is noted for the RECENT dummy. Firms subsidized after the year 2000 had a 68.52% lower chance of getting a restructuring subsidy than firms subsidized before 2001, ceteris paribus. This time effect is very strong, suggesting that bailout policy of governments has starkly changed in the recent years. The Lisbon Strategy announced in 2000 might be a driver of this change.

In both specifications the marginal effect of public ownership is statistically significant, however it has opposite signs. In the first model, the estimate reaches 29%. In the

second model, when I control for public and private employment separately, the effect of public ownership turns into -78.1%. The coefficients on both types of employment in model 2 are not significant. Still, p-values are not too high, so it is worth to interpret the marginal effects. The effect of private employment is negative and the effect of public employment is positive. How to think of these results? Public ownership alone does not increase chances for restructuring of aid, in contrary to what I expected, but it decreases these chances dramatically. What makes governments to spend more money on a bailout is actually public employment. The bigger public firms, the more likely restructuring aid. Employment in private firms has the opposite effect: the bigger a private firm, the less likely restructuring aid. That puts the argument of the prevention of job losses by bailouts in a doubtful light: public jobs are indeed supported more, but private jobs are disadvantaged.

Industry effects are highly insignificant. Among country effects, ITALY effect is significant, negative and rather large. Holding everything else constant, Italian firms were less likely to receive restructuring aid by about 51%. The effect of France is close to significant and negative.

Robustness

Several robustness checks were performed. First, I redefine the variable RECENT as time trend, time squared, logarithm of time and annual or biannual dummies. The results were robust to these changes in sign and significance, but the model with the dummy had the highest joint-significance χ^2 statistics. Therefore, I use RECENT as the best trend-indicator. Second, I estimate the equation using the logit model. Results are very similar as the probit estimates, suggesting the model's stability. Third, I use firms' age as a regressor. Age is measured in years between incorporation and the subsidy. The coefficient was insignificant in the regression and I decided to omit it because of numerous missing data in this variable.

Privatization and old public firms

Two important variables were perfectly predicting the subsidy choice. The first one is privatization. Privatization through bailouts means that a public firm was bailed out and, having received the subsidy, it was sold to private owners. Among all bailouts in years 1992-2003, 13 cases involved privatization. In a few cases, it was a requirement of the Commission in the approval process, but usually it was an initiative of the governments themselves. All 13 privatized firms got restructuring aid, implying that governments used substantial public funds to increase the value of the firm before the subsequent sale.

The second perfect predictor is age for state-owned firms. All 8 state-owned firms older than 100 years received exclusively restructuring aid, suggesting that governments supported old state-owned enterprizes.

Summary

Summing up, the time dummy has the most important impact on the governments' choice of the subsidy type. The estimates suggest that there was a structural change in the bailout policy: after the year 2000 governments chose rescue subsidies with a higher probability than restructuring aid, and the opposite is true for the earlier years. State-owned firms get more restructuring aid mainly due to governments' preference to support public employment. Old state-owned firms and privatized firms were supported with only restructuring aid. Industrial sectors do not matter in the policy choice. Italian governments grant rescue aid somewhat more often than restructuring aid, while other governments do not have a special policy.

2.4.2 Endogenous subsidy choice

In this section, the equations (2.10) and (2.11) are estimated simultaneously. Such an approach allows to correct for potential endogeneity of the subsidy type variable in the hazard equation. It is also a useful robustness check for the earlier results. Since estimators for a simultaneous model with a discrete-time hazard rate and a discrete-choice equation are to my knowledge not yet available,[24] I translate the hazard rate equation into a time-invariant binary outcome equation with one observation per firm. Then a bivariate probit estimator can be used.[25] Duration dependence will be captured by adding the RECENT dummy.

The problem has a recursive nature: first the government decides which type of aid to grant and then, often a few years later, competition in the market forces the firms to exit or not. Therefore, a recursive bivariate probit specification seems appropriate: equation (2.11) explains the choice of the subsidy type, equation (2.10) explains the exit pattern depending on the subsidy type.[26] The error terms in both equations could be correlated if there are unobservable factors that have an impact both on the subsidy type choice and the bankruptcy chances. Examples of such factors are the degree of firms' unionization or lobbying by firms. In the equations, I do not control for them directly, but they are taken

[24] This is left for future research. For a continuous-time hazard, a full information maximum-likelihood estimator was recently proposed by Boehmke et al. (2006).

[25] E.g. Wooldridge (2002), p. 477.

[26] A relevant remark here is that when governments choose the subsidy type, they possibly take exit probability into account, so that exit is also endogenous to the subsidy type. This issue is addressed in the subsection on the robustness of the results.

into account using error terms. The econometric model which best fits this situation is a bivariate probit. I will therefore estimate the following model:

$$\begin{cases} \text{TYPE}_i & = \mathbb{I}(\beta_1' X_{1i} + \varepsilon_{1i} > 0) & IndustrialPolicy \\ \text{BANKR}_i & = \mathbb{I}(\alpha \text{TYPE}_i + \beta_2' X_{2i} + \varepsilon_{2i} > 0), & Bankruptcy \end{cases} \tag{2.12}$$

where i is a firm index, vector $(\varepsilon_1, \varepsilon_2)$ has a bivariate normal distribution with mean zero, unit variances and $\text{corr}(\varepsilon_1, \varepsilon_2) = \rho$. I apply maximum likelihood estimation method. Table 2.14 presents the results. To facilitate a comparison, I include estimates of coefficients for several models. Models 1, 2, 4 and 5 are the results of single-equation probit estimations. Models 3 and 6 are the simultaneous specifications. In models 1-3 I control for employment in general, while in models 4-6 I distinguish between private and public employment.

The log-likelihood of the simultaneous models is higher than the sum of the log-likelihoods for the two equations estimated separately. The likelihood-ratio test indeed rejects the hypothesis that $\rho = 0$ (for model 3: test statistics $\chi^2(1) = 6.7956$, p-value 0.0091, for model 6: $\chi^2(1) = 6.04384$, p-value 0.0140). According to Monfardini and Radice (2006), the likelihood-ratio test is the best method to test correlation of equations in case of small samples. Therefore, the results indicate that the equations in model (2.12) are correlated: unobserved factors influencing the chance for a restructuring aid have impact on the probability of bankruptcy.

Simultaneous estimation of both equations (models 3 and 6) does not change the coefficients' estimates too much, but suggests that the endogeneity issue is important for the results. In the bankruptcy equation of the simultaneous models, the coefficient on TYPE decreases when compared with the independent estimation. I therefore find that having separated the effect of beneficiaries characteristics on the industrial policy, restructuring aid is even more effective in preventing exit. If beneficiary characteristics erode the performance of restructuring aid, then firms receiving restructuring aid are not necessarily the most efficient ones.

In the industrial policy equation of model 3, the positive coefficient of PUBLIC becomes smaller and less significant than in model 1, but its p-value of 0.157 is still not too high. This result suggests that public firms have a better chance to receive restructuring aid than private firms. The coefficient of PUBLIC in the bankruptcy equation is, however, not significant, suggesting that public firms are not better in survival than private firms. Therefore, governments' preference for public firms cannot be explained by these firms' higher probability of fulfilling bailouts' goals.

The effect of SIZEPRIVATE in model 6 becomes significant and much lower than in

Table 2.14: Estimates of coefficients in bivariate probit model.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Industrial policy						
recent	-2.031***		-1.921***	-2.040***		-1.737***
	(0.003)		(0.003)	(0.006)		(0.003)
public	0.821*		0.582	-2.532		-3.220
	(0.077)		(0.157)	(0.250)		(0.118)
employment	-0.042		-0.097			
	(0.769)		(0.513)			
sizeprivate				-0.246		-0.438**
				(0.204)		(0.026)
sizepublic				0.219		0.110
				(0.326)		(0.576)
infrastr	0.649		0.883	0.346		0.676
	(0.433)		(0.259)	(0.694)		(0.336)
service	0.409		0.345	-0.019		-0.279
	(0.679)		(0.710)	(0.986)		(0.782)
minman	-0.211		-0.150	-0.581		-0.395
	(0.720)		(0.823)	(0.377)		(0.562)
Germany	-0.077		-0.207	-0.318		-0.693
	(0.906)		(0.726)	(0.650)		(0.215)
France	-0.788		-0.462	-1.237		-1.072
	(0.382)		(0.504)	(0.207)		(0.151)
Italy	-0.931		-1.130	-1.406		-1.750**
	(0.227)		(0.108)	(0.101)		(0.042)
Spain	0.139		-0.114	0.037		-0.386
	(0.854)		(0.857)	(0.962)		(0.568)
Austria	-0.055		-0.221	-0.385		-0.796
	(0.953)		(0.781)	(0.694)		(0.342)
Bankruptcy						
Subsidy type		-1.496***	-2.679***		-1.491***	-2.611***
		(0.001)	(0.000)		(0.002)	(0.000)
recent		-1.339**	-1.845***		-1.479**	-2.026***
		(0.018)	(0.000)		(0.014)	(0.000)
public		-0.053	0.301		1.487	1.153
		(0.894)	(0.412)		(0.405)	(0.490)
employment		-0.018	-0.028			
		(0.879)	(0.798)			
sizeprivate					0.101	0.048
					(0.579)	(0.777)
sizepublic					-0.118	-0.081
					(0.478)	(0.603)
service		-0.327	-0.498		-0.180	-0.295
		(0.711)	(0.512)		(0.841)	(0.694)
minman		0.296	0.130		0.372	0.244
		(0.460)	(0.720)		(0.367)	(0.523)
N	65	65	65	65	65	65
pseudo-R2	0.277	0.190		0.307	0.200	
log-likelihood	-30.936	-32.489	-60.403	-29.667	-32.090	-58.359
chi2	23.74	15.26	68.65	26.277	16.061	68.308
p	0.013	0.000	0.018	0.010	0.025	0.000

Population: Cross-section. P-values in parenthesis.
***(**,*) denotes significance with 1% (5%, 10%) level in a two-tailed Wald test.

model 4. This implies that the bigger a private firm, the less likely restructuring aid. The size of public firms is less important for the subsidy choice. This observation supports the earlier suggestion that governments discriminate between public and private employment to the disadvantage of the latter.

The coefficient's estimates for the RECENT variable in both equations of the simultaneous models are significant. Compared with the single-equation specifications, they change their magnitudes rather moderately. Thus, timing and duration play an important role in both processes. In the exit process, firms subsidized only in the last three years had lower bankruptcy probability. Regarding the industrial policy, rescue aid was more likely in the last three years.

Robustness

If governments condition the decision about the subsidy type on the chances of the firm in trouble to survive, the variable BANKR should be present in the second equation of the model (2.12). However, a simultaneous equation model with two endogenous discrete variables one being a function of the other suffers from logical inconsistency (Maddala, 1983, p. 117.). I address this issue by estimating a "reverse" recursive model, in which the probability of bankruptcy is a function of exogenous variables only and the subsidy type choice is a function of the bankruptcy chances and a set of exogenous variables:[27]

$$\begin{cases} \text{TYPE}_i & = \mathbb{I}(\alpha \text{BANKR}_i + \beta_2' X_{2i} + \varepsilon_{2i} > 0), \quad & \mathit{IndustrialPolicy} \\ \text{BANKR}_i & = \mathbb{I}(\beta_1' X_{1i} + \varepsilon_{1i} > 0) & \mathit{Bankruptcy} \end{cases} \tag{2.13}$$

However, this regression does not go through the basic diagnostics. In the specification with one employment variable, the likelihood ratio test cannot reject the hypothesis that $\rho = 0$ ($\chi^2(1) = 0.000293$, p-value 0.9863). The hypothesis that the coefficients are jointly insignificant cannot be rejected either (Wald $\chi^2(17) = 20.24$, p-value 0.262). The specification with separated public and private employment gives similar results. The model (2.13) is without any doubt inferior to the model (2.12).

2.5 Conclusions

The results in this paper contribute to the understanding of the European bailout policy used in the past. Increasing bankruptcy rate and a relatively high share of failing bailouts suggest scope for improvements in this policy. Soft-budget constraints are of particular concern. A simple and practical solution to remedy this problem was already suggested

[27] This approach is used by Beck (2004).

by Nitsche and Heidhues (2006) and I strongly support it: bailouts should be limited to firms in formal bankruptcy. In this way, incentives of managers to apply for a bailout will be reduced. Chapter 11 protection in the U.S. provides an example of this approach.

Empirical evidence on bailouts of state-owned firms shows weaknesses of using state aid as an instrument to prevent bankruptcy of firms. State-owned firms are overrepresented among R&R aid beneficiaries and receive restructuring aid more often than their private competitors. At the same time, they do not go bankrupt less often. Clearly, governments favor public firms in the bailout decisions. Such a policy is almost certain to create soft-budget constraints for state-owned firms.

An important issue not addressed in this paper is the selection process to the R&R subsidy program. Far more firms go bankrupt than are bailed out. An empirical analysis of the determinants of the choice to bailout or not would provide more detailed evidence on the bailout policies in member states. Another interesting research problem is an empirical analysis of balance sheet data for R&R aid beneficiaries before aid and during the restructuring process. Going to the accounting data would allow to account for the amount and form of aid and would provide evidence on the sources of distress, how the aid was spent and how many jobs it saved. These are issues left for further research.

2.6 Appendix

2.6.1 Industry classification

NACE (Rev.1) comes from the French term *Nomenclature statistique des Activités économi-ques dans la Communauté Européenne* (Statistical classification of economic activities in the European Community) and is a European industry classification system. At the 2-digit level NACE is fully compatible with ISIC. Table 2.15 presents the codes used in this paper.

2.6.2 Data set description

The data set contains information on R&R subsidy cases in the European Union in years 1995-2003. It is a unique data set created from four data sources. Subsidy information comes from the texts of the European Commission's decision and the report by London Economics (2004) provided by Competition Directorate General. Financial and ownership information on firms from sectors other than financial comes from AMADEUS database provided by Bureau van Dijk Electronic Publishing. For firms from the financial sector I use annual reports, if available. Other firm-level data comes from newspapers.

Table 2.15: Two-digit NACE classification.

Industry	**NACE codes**
Mining	12-14
Manufacturing	15-37
Electricity and water supply	40-41
Construction	45
Trade	50-52
Transport	60-64
Financial services	65-67
Other services	55, 70-99

I construct three data sets. A cross-section of decisions is a set with a decision as a unit of observation, it entails 86 observations in total. A cross-section of firms is a set with a firm receiving R&R aid as a unit of observation, it entails 79 observations in total. Finally, a panel is a two-dimensional set with aid receivers observed across time.

I build a panel based on the following principles. Subjects in the panel are all R&R subsidy beneficiaries, whose surviving status is known in at least one year. This amounts to 75 firms. Each firm was observed from the year it was bailed out until 2003 or its earlier bankruptcy. Bankruptcy is defined as ceasing the major activity of a firm. 22 R&R subsidy beneficiaries went bankrupt in the time between receiving the subsidy and the end of 2003. The remaining 53 firms were observed until the year 2003 without going bankrupt. Following the survival literature, I call them right-censored or lost, but in my context they are simply firms, which from the subsidy year up to 2003 stayed in operations. All in all, for the survival analysis I have an unbalanced panel of 409 observations, with 75 firms observed during the years 1992-2003.

2.6.3 Basic definitions in survival analysis

This appendix is based on Jenkins (2004). Survival analysis deals with a time-to-event random variable called also spell length, spell duration or survival length. The researcher is interested in the distribution of time needed to observe the event. The event can be anything, but in the first applications it was death and for this reason it is often referred to as a failure. Examples of the applications include examination of the effectiveness of medicines by comparing life lengths of treated and non-treated patients, failure rates for machines in the production process, bankruptcy rates, marriage patterns etc. In each case, the failure is an event of transition from one state to another: death, bankruptcy, marriage.

Assume first that time is continuous. T is the spell length, the random variable with the

Table 2.16: Variables used and their sources.

Variable	Definition	Source
Subsidy year	Year of subsidy transfer	decision texts
Subsidy type	Rescue or restructure	decision texts
Country	Country of the subsidizing government	decision texts
State-owned	Dummy equal to 1 if the state owns more than 50% of shares	decision texts, AMADEUS, LE report
Year of incorporation	Year in which the firm started operations	AMADEUS, LE report
Year of bankruptcy	Year in which the firm went bankrupt	LE report, newspapers
Industry	Industry with the highest share in the revenue, based on NACE (see table 2.15)	AMADEUS, LE report
For sale	Dummy equal to 1 if after getting the subsidy the firm was sold.	LE report, newspapers
Employment	Number of employees	AMADEUS, LE report, annual reports

distribution function $f(t)$ and a c.d.f. $F(t)$ (called also the failure function). The survivor function is the probability of survival $S(t) = Pr(T > t) = 1 - F(t)$. The continuous hazard rate is defined as

$$\theta(t) = \frac{f(t)}{1 - F(t)} \tag{2.14}$$

and can be interpreted as an instantaneous "probability" of failure in time t conditional on surviving until t. It is not a real probability, however, since its values are not necessarily from the range $[0, 1]$.

The basic relationships between the failure, survivor and hazard functions can be derived as follows.

$$\theta(t) = \frac{f(t)}{1 - F(t)} = \frac{\partial(1 - F(t))/\partial t}{1 - F(t)} \tag{2.15}$$

$$= \frac{\partial[-\ln(1 - F(t))]}{\partial t} = \frac{\partial[-\ln(S(t))]}{\partial t}. \tag{2.16}$$

Now integrate both sides

$$\int_0^t \theta(u)du = -\ln(1 - F(t))|_0^t \tag{2.17}$$

and use $F(0) = 0$ and $\ln 1 = 0$ to get

$$\ln[1 - F(t)] = \ln(S(t)) = -\int_0^t \theta(u)du \tag{2.18}$$

$$S(t) = \exp(-\int_0^t \theta(u)du) \tag{2.19}$$

$$S(t) = \exp[-H(t)] \tag{2.20}$$

where $H(t) = \int_0^t \theta(u)du = -\ln(S(t))$ is an integrated hazard function. The final relationship is just an observation that

$$H(t) \geq 0, \tag{2.21}$$

$$\frac{\partial H(t)}{\partial t} = \theta(t). \tag{2.22}$$

Now suppose the time is discrete. Discrete time means that the real timeline is divided into intervals:

$$[0 = a_0, a_1], (a_1, a_2], (a_2, a_3], ...(a_{k-1}, a_k = \infty]. \tag{2.23}$$

The probability of failure at the end of interval j is then $F(a_j)$. The survivor function at the end of the interval j is $S(a_j) = Pr(T > a_j) = 1 - F(a_j)$.

The discrete hazard rate for the interval j is defined as the probability of failure in the interval j, conditional on surviving until the beginning of the interval j

$$h(a_j) = Pr(a_{j-1} < T \leq a_j | T > a_{j-1}) \tag{2.24}$$

$$= \frac{Pr(a_{j-1} < T \leq a_j)}{Pr(T > a_{j-1})} \tag{2.25}$$

$$= \frac{S(a_j) - S(a_{j-1})}{S(a_{j-1})} \tag{2.26}$$

$$= 1 - \frac{S(a_j)}{S(a_{j-1})}. \tag{2.27}$$

Note that the discrete hazard rate is a proper (conditional) probability.

Chapter 3

Bailouts in a common market: a strategic approach

3.1 Introduction

Bailouts by governments in the European Union are strictly regulated. Each time they must be approved by the EC Commission and the approval is conditional on a set of criteria gathered in the "Community Guidelines on State Aid for Rescuing and Restructuring Firms in Difficulty"[1]. The guidelines focus on limiting distortions of competition to the minimum and give strict conditions for approvals of bailouts, e.g. one time -last time principle or a convincing restructuring plan which brings the firm back to viability. Compensation measures are often imposed, such as selling a part of the market share to competitors of the beneficiary or privatization. The reason for these strict conditions is that rescue and restructuring (R&R) subsidies are particularly prone to distort competition among member states, as they may be acting against competitive forces which caused the exit. Such subsidies disadvantage competitors, who have to restructure with their own resources.

Strategic trade theory confirms this concern: literature started by Brander and Spencer (1983) shows that if countries grant subsidies strategically, they can improve the position of the subsidized national champion at the expense of the foreign firm. To the best of my knowledge, however, none of these models allows for a subsidy to bail out an exiting firm, since only interior solutions in the output game are analyzed. To analyze R&R subsidies one needs to account for endogenous exit, which is my contribution to the literature.

In addition, strategic trade theory typically assumes that home and foreign firms compete in a third country, so the governments do not consider consumer surplus in their decisions about aid (an exception is Collie (2000, 2002)). Still, consumer surplus is an

[1] Official Journal of the European Union, 2004/C 244/02

important aspect in the debate on R&R, since monitoring of state aid in the EU is said to take place in order to protect consumers' interests.[2] Therefore, the common market structure is incorporated into the analysis: the subsidizing government maximizes not only profits of firms in her country, but also country's share in consumer surplus. Countries in the EU are very different in size, therefore asymmetry in this share is also accounted for.

Lahiri and Ono (1988) and Neary (1994) recommend social planners to tax high-cost and subsidize low-cost firms. Such policy creates a higher concentration in the market, but it improves welfare, since the firms with the increased market share are also more efficient. From this perspective, R&R subsidy shifts resources in the "wrong" direction, because it is meant to increase market share of the inefficient firm. The problem is that individual governments maximize only a part of total EU welfare, so a bailout profitable for one country, but still harmful for the EU. I asses the externalities of R&R subsidies on welfare in the EU in total and for member states of different sizes separately.

I consider a duopoly with two firms, each located in a different country, but selling in a common market. The firms have ex ante asymmetric unit production cost. They restructure in order to decrease these costs and then compete by setting quantities. Exit results from production inefficiency in one of the firms. In such a case the government can rescue the firm by subsidizing some additional restructuring and the bill is paid by consumers from the country of the aid beneficiary. When making this decision, the government maximizes welfare defined as profit of the firm and country's share in consumer surplus. I am interested in two issues: the benefit from keeping the inefficient firm in the market and externalities of R&R subsidies on all players in the model. I also look for a rationale for strict control of R&R subsidies in the EU.

There are two main results. First, an R&R subsidy fulfils two different roles. If cost differences are not too high and the subsidizing country small enough, the subsidy rescues the inefficient firm (I call this a *successful rescue*), increases welfare of the intervening country by increasing the profits of the aid beneficiary and decreases the surplus of all consumers. If the cost asymmetry is higher, the subsidy is paid out, but it does not prevent the firm from exit (which I call a *failed rescue*). The subsidy is however only an apparent waste, since it provides a threat of no-exit to the efficient firm and forces this firm to cut its cost more than an unconstrained monopoly would. This strategic effect improves both productive and allocative efficiencies. The government is willing to grant such a subsidy, because consumer surplus increases as the result of this intervention.

Second, externalities of the subsidy differ depending on whether the rescue succeeds or not. In a successful rescue, consumers and the competitor of the beneficiary are worse

[2]EU competition policy and the consumer, *Luxembourg: Office for Official Publications of the European Communities*, 2004.

off, while the subsidized firm gains. In a failed rescue, consumers are better off and the competitor loses. Externalities on welfare depend on the country's share in consumer surplus (I call it *country's size*). The size determines the amount of aid paid out and the way gains from the subsidy are distributed between member states. If the country is small, the government cares relatively more about the profits than about the price and therefore the subsidy is successful for a large set of initial cost asymmetries. Welfare of the other country and total welfare are reduced. When the subsidizing country is big enough, only failed rescues take place. Externality on welfare of the other country is negative, but total welfare increases thanks to the higher consumer surplus.

If consumer surplus or total welfare were her objective, the Commission should ban R&R subsidies which are likely to prevent exit, since they result in a price rise and a loss in productive efficiency. In reality, however, not only efficiency but also equality objectives are pursued in state aid policy. This paper showed only one piece of the puzzle: how bailouts affect efficiency and how they distort competition. In this way I want to contribute to the discussion on state aid policy in the EU, which is at the top of the agenda of the current Competition Commissioner Neelie Kroes[3].

3.2 Model Setup

There are two countries. Each country has one government and one firm. Firms produce a homogenous good, which is sold in a common market without barriers to trade. Governments maximize welfare defined as profit of the firm in their country and the country's share in consumer surplus. Let the first country's share in consumer surplus be α and the second country's share $1-\alpha$. Denoting welfare in country i as W_i:

$$W_1 = \pi_1 + \alpha CS \tag{3.1}$$

$$W_2 = \pi_2 + (1-\alpha)CS \tag{3.2}$$

$$W = W_1 + W_2 = \pi_1 + \pi_2 + CS. \tag{3.3}$$

Firms maximize profits. Production cost functions are linear with asymmetric marginal costs denoted by c_1 and c_2 and without loss of generality assumed $c_1 > c_2$. This asymmetry is exogenous. Inverse demand is $P = P(x)$, where $x = x_1 + x_2$ with $P'(x) < 0$. The game has three stages. First, the government with the less efficient firm commits to subsidize restructuring if the firm has to exit without help. Then firms restructure on their own and finally firms compete by setting quantities. Restructuring is modeled as process-R&D: it means cutting marginal cost by e_i at the cost of $\frac{d}{2}e_i^2$, where $d > 0$. It is important to note

[3]Introductory Statement at EMAC Open Meeting of Coordinators, Feb. 3rd, 2005.

that the cost of restructuring is the same for both firms and for the government.[4] I solve for the subgame-perfect Nash equilibrium by backward induction.

If there is no exit, there is no subsidy and firms' profits are

$$\pi_i = P(x)x_i - (c_i - e_i)x_i - \frac{d}{2}e_i^2 \quad i = 1,2. \tag{3.4}$$

As typically happens in asymmetric Cournot games, if the initial marginal cost difference is high enough, the less efficient firm exits and a monopoly of the more efficient one emerges in the equilibrium. Government 1 anticipates when firm 1 will exit in the equilibrium. In such a case, the government can subsidize further restructuring in firm 1 by $\frac{d}{2}k_1^2$ and reduce marginal costs additionally by k_1. Two payoffs are changed (with subscript s):

$$\pi_{1s} = P(x)x_1 - (c_1 - e_1 - k_1)x_1 - \frac{d}{2}e_1^2 \tag{3.5}$$

$$W_{1s} = \pi_{1s} - \frac{d}{2}k_1^2 + \alpha CS. \tag{3.6}$$

This definition of subsidy is similar to definitions used in the literature in the sense that it affects marginal costs directly.[5] On the other hand, R&R subsidy differs from commonly used subsidy definitions, because with the subsidy the government gives her own restructuring technology to the firm. She behaves as an entrepreneur and actually makes some decisions, what gives country 1 a cost advantage since $\frac{d}{2}e_1^2 + \frac{d}{2}k_1^2 < \frac{d}{2}(e_1 + k_1)^2$. In reality, transfer of technology often happens in R&R cases, since governments and public agencies actively participate in designing a restructuring plan or negotiating with unions. Sometimes the government hires a consulting firm to do the job of exit prevention. Generally one can say that when bankruptcy is in sight, governments take unusual measures to save the firm and these unusual measures are the new restructuring technology.

Government 2 cannot subsidize, which is another asymmetry in the model and it is introduced in order to reflect the rules in the EU: only otherwise exiting firms can be subsidized and firm 2 in the equilibrium of the benchmark no-subsidy model never exits.

Finally, a comment on technical issues. The problem is by nature asymmetric. Since asymmetric general models are difficult to solve, I make a compromise by choosing specific functional forms of both cost functions (linear and quadratic), leaving demand gen-

[4] One could argue that restructuring is more expensive for the low-cost firm since it has no "slack" or X-inefficiency, so that for example parameter d for this firm should be higher. It is a valid concern, since Aghion and Schankerman (2004) allow for such slack and find that the equilibrium can have very different properties than in the symmetric case. However, such an assumption is beyond the scope of this paper.

[5] Møllgaard (2004) is an exception, defining aid as a reduction in the cost of capital.

eral and using linear demand case as an example. Welfare effects are presented only for the example of linear demand. This model structure is motivated by the fact that properties of the demand function seem to be crucial for optimal R&D subsidies. For example, Lahiri and Ono (2004) show that, when firms are symmetric, the sign of the subsidy is the same as the sign of the second derivative of demand. I limit the attention to pure strategy equilibria.

3.3 Benchmark Equilibrium: no subsidy

As a benchmark for the rescue subsidy game a two-stage game is considered, where both governments are passive and their payoffs result only from actions of firms. Firms simultaneously choose restructuring level and then decide about output level. Since exit is not excluded, which is an unusual aspect of this model, I will look at this game in some detail.

In the second stage of the game, first order conditions for duopoly equilibrium are

$$P'(x)x_i + P(x) - c_i + e_i = 0 \quad i = 1,2. \tag{3.7}$$

which implicitly define $x_i(e_1, e_2)$. The second order conditions $P''(x)x_i + 2P'(x) < 0$, and stability conditions $P''(x)x_i + P'(x) < 0$ and $\frac{\partial^2 \pi_i}{\partial x_i^2} > \frac{\partial^2 \pi_i}{\partial x_i \partial x_j}$ are assumed to hold. Totally differentiating (3.7) and using the assumptions, comparative statics results are obtained:

$$\frac{dx_i}{de_i} > 0 \quad \frac{dx_j}{de_i} < 0 \quad \frac{dx}{de_i} > 0, \tag{3.8}$$

which indicate that restructuring expands own and total output, while reducing competitor's output. In the first stage, the first order conditions[6] are

$$P'(x)x_i \frac{\partial x}{\partial e_i} + (P(x) - c_i + e_i)\frac{\partial x_i}{\partial e_i} + x_i - de_i = 0 \quad i = 1,2 \tag{3.9}$$

and using (3.7) can be simplified to

$$x_i + x_i P'(x)\frac{\partial x_j}{\partial e_i} = de_i \quad i = 1,2. \tag{3.10}$$

The marginal cost of restructuring (right-hand side) equals the marginal revenue (left-hand side), which is composed of two effects. The direct effect is just a decrease of the production cost, represented here by x_i. The second expression represents the strategic effect restructuring has on the competitor's output. Since both derivatives in this expression

[6]The second order conditions are assumed to hold.

are negative, their product is positive, so the strategic effect increases marginal revenue of restructuring.

Equations (3.7) and (3.10) implicitly define the equilibrium $x_i^D(c_1,c_2)$ and $e_i^D(c_1,c_2)$ (D stands for duopoly).

Comparing duopoly restructuring levels e_1^D and e_2^D, Lahiri and Ono (2004) p.24 prove the following

Proposition 1 *The firm with lower initial marginal cost invests more in restructuring.*

Low-cost firm reduces marginal cost by more than the rival, so that the initial cost difference is magnified. This observation goes back to the hypothesis of Schumpeter that big firms are better innovators (in terms of production process) than high-cost firms, since they are able to exploit cost-cuts on a larger scale.

For $c_1 - c_2$ sufficiently high, a monopoly of firm 2 is the equilibrium. Two qualitatively different outcomes emerge: a blockaded monopoly, which operates unconstrained by the less efficient rival, and an entry-deterring monopoly, where the rival is strategically excluded from the market. First I consider a blockaded monopoly. The first order condition in the output stage is

$$P'(x_2)x_2 + P(x_2) - c_2 + e_2 = 0, \tag{3.11}$$

which implicitly defines $x_2(e_2)$. I assume second order condition $P'' + 2P' < 0$ to hold. Differentiating (3.11) with respect to e_2 and using the second order condition I find that

$$\frac{dx_2}{de_2} > 0. \tag{3.12}$$

In the first stage, the first order condition[7] is

$$P'(x_2)x_2\frac{\partial x_2}{\partial e_2} + (P(x_2) - c_2 + e_2)\frac{\partial x_2}{\partial e_2} + x_2 - de_2 = 0 \tag{3.13}$$

and using (3.11) it boils down to a simple equation

$$x_2 = de_2. \tag{3.14}$$

In case of monopoly there is no strategic effect of e_2 on x_1, so the effect of restructuring is just the reduction of the production cost. Equations (3.11) and (3.14) together define $x_2^M(c_2)$ and $e_2^M(c_2)$ (M stands for monopoly).

When entry-deterrence takes place, firm 2 increases its output above monopoly level to exclude the competitor. In such a situation, x_2 is at the level which nullifies $x_1(e_1,e_2)$

[7] I assume the second order conditions to hold.

calculated from (3.7), that is x_2 such that

$$[P'(x_1+x_2)x_1+P(x_1+x_2)-c_1+e_1]_{x_1=0}=0, \tag{3.15}$$

from which it follows that

$$P(x_2)=c_1-e_1. \tag{3.16}$$

Optimal output of firm 1 is then 0, and therefore also restructuring level is zero: $x_1^E=0$ and $e_1^E=0$ (E stands for entry-deterrence). Going back to equation (3.16), it follows that

$$P(x_2^E)=c_1. \tag{3.17}$$

Firm 2 produces as much as is necessary to price the good at the marginal cost of the competitor and in this way enforces its exit. The optimal restructuring level leading to this output follows from equation (3.14):

$$x_2^E=de_2^E. \tag{3.18}$$

3.3.1 Linear Demand Example

If inverse demand is linear, e.g. $p=1-x_1-x_2$, the equilibrium can be explicitly calculated. To simplify complex calculations, I fix the parameters d and c_2. I choose $d=5$ so that all profit functions are concave and $c_2=0.4$ so that I avoid a number of corner solutions and focus exclusively on the role of the asymmetry in initial cost for the market structure in the equilibrium[8]. Let us define $\underline{c_1}=0.485749$, $\tilde{c_1}=0.532987$ and $\overline{c_1}=0.6667$.

Proposition 2 *For $c_1\in(0.4,\underline{c_1})$ duopoly emerges in the equilibrium with optimal strategies:*

$$e_1^D=4\frac{17-26c_1}{451} \qquad x_1^D=\frac{15}{4}e_1^D \tag{3.19}$$

$$e_2^D=4\frac{0.6+15c_1}{451} \qquad x_2^D=\frac{15}{4}e_2^D. \tag{3.20}$$

Entry-deterring monopoly of firm 2 emerges when $c_1\in(\tilde{c_1},\overline{c_1})$. Optimal strategies are

$$e_2^E=\frac{1-c_1}{5} \qquad x_2^E=5e_2^E. \tag{3.21}$$

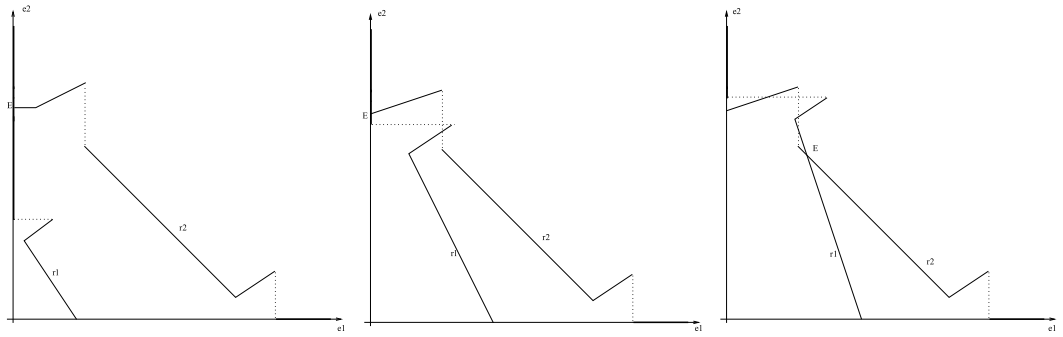
[8]Qualitatively, I get the same results choosing any $d\in(4,\infty)$ and $c_2\in(0.2,0.5)$. For $c_2<0.2$ there are more and for $c_2>0.5$ less corner solutions to consider, but the mechanism is the same.

For $c_1 \in (\overline{c_1}, 1)$ equilibrium market structure is blockaded monopoly of firm 2 with optimal strategies

$$e_2^M = \frac{1}{15} \qquad x_2^M = 5e_2^M. \tag{3.22}$$

The proof can be found in the Appendix, but in order to build some intuition figure 3.1 presents the reaction functions of the three equilibrium market structures in the first stage of the game.

Figure 3.1: Three market structures emerge in the equilibrium of the benchmark game.



(a) monopoly (b) entry-deterrence (c) duopoly

Figure 3.1(a) shows the case when firm 2 has a very high efficiency advantage. Its reaction function is composed of 5 pieces. For e_1 very low, best-reply of firm 2 is a blockaded monopoly with restructuring constant in e_1. When e_1 is higher, firm 2 deters entry of firm 1 by increasing its restructuring level. This is the second, increasing part of the reaction function. For higher e_1, best reply is accommodation, so that the outcome is duopoly. In that case the reaction function is decreasing. The fourth piece is where duopoly as a corner solution is the best-reply. Finally, if e_1 is too high, best reply is not to restructure and exit, so the reaction function coincides with e_1 axis. Firm 1's reaction function has only 3 pieces, since firm 1 has a higher initial production cost and neither monopoly nor entry-deterrence are achievable, but the logic is the same. Both reaction functions cut in point E, where firm 1 chooses to exit and firm 2 restructures at the monopoly level.

Figure 3.1(b) shows the case when firm 2 has a moderate efficiency advantage. Its reaction function is pushed to the left, so that monopoly part is not possible for positive e_1. The equilibrium is entry-deterrence by firm 2, since firm 2's best-reply to $e_2 = 0$ is entry-deterring restructuring level, which is higher than in monopoly. Finally, figure 3.1(c) shows duopoly equilibrium, where downward-sloping parts of the reaction functions cut and both firms end up with positive restructuring and production.

Looking at the functional forms of the duopoly restructuring levels (3.19) and (3.20), one can notice that the result exemplifies Proposition 1: for $c_1 > 0.4$ restructuring levels fulfil $e_1^D < e_2^D$, and the final cost difference is higher than initially. This result is robust to the definition of competition: Aghion and Schankerman (2004) got it for Salop model, Lahiri and Ono (2004) for Cournot duopoly with general demand, Escrihuela-Villar (2004) for n-firm Cournot competition with linear demand, Röller and Sinclair-Desgagne (1996) for two-market Cournot duopoly. In entry-deterrence outcome (3.16), however, e_2^E decreases with c_1, since the bigger the initial cost difference, the bigger efficiency advantage of firm 2, so that less aggressive predatory behavior is sufficient to deter entry of firm 1. This finding will be crucial in further analysis.

3.4 Subsidy Equilibrium

If the initial cost asymmetry is too big, the inefficient firm exits (in the example it happens for $c_1 > \tilde{c_1}$). In the EU, a government could then subsidize some additional restructuring in that firm. This possibility is introduced to the game by extending the benchmark model with a stage where the government can choose to do it.

The new game has three stages. In the first stage, government 1 commits to subsidize firm 1's restructuring process with $s = \frac{d}{2}k_1^2$ in order to lower its marginal cost by k_1 if without help the firm exits. Government 2 is not allowed to subsidize. In the second stage firms choose their restructuring level and the subsidy is paid. In the third stage they compete á la Cournot. Such formulation of the game reflects the rules of the EU common market, where governments can subsidize restructuring of ailing firms and they usually get involved into restructuring process. The outcomes are denoted by a subscript s.

In the third stage, when duopoly emerges, the first order conditions are

$$P'(x)x_1 + P(x) - c_1 + e_1 + k_1 = 0 \tag{3.23}$$

$$P'(x)x_2 + P(x) - c_2 + e_2 = 0. \tag{3.24}$$

The second order conditions $P''(x)x_i + 2P'(x) < 0$ and stability conditions are assumed to hold. Comparative statics analogous to the benchmark derives

$$\frac{dx_1}{dk_1} > 0 \quad \frac{dx_2}{dk_1} < 0 \quad \frac{dx}{dk_1} > 0. \tag{3.25}$$

The subsidy works exactly like restructuring by firm 1. It increases the output of the beneficiary at the cost of its more efficient competitor and the total output is also increased. This is the traditional business-stealing effect of subsidies in strategic trade sub-

sidy games.

In the second stage of duopoly, the first order conditions are just like in the benchmark case:

$$x_i + x_i P'(x)\frac{\partial x_j}{\partial e_i} = de_i \quad i = 1,2. \tag{3.26}$$

Conditions 3.23 and 3.26 together implicitly define equilibrium outputs and restructuring as functions of k_1. Just as before, restructuring has a direct and a strategic impact on the marginal revenue.

In entry-deterrence, if the subsidy is positive, the increase of output in firm 2 must be such that

$$P(x_2^{Es}) = c_1 - k_1. \tag{3.27}$$

This equation shows the strategic effect of the subsidy. The government changes the initial conditions of the game between the firms: firm 2 has to adapt its strategy to the lower initial cost of firm 1. Since demand is decreasing, the outputs satisfy $x_2^E < x_2^{Es}$. Firm 2 produces more output to deter firm 1, because firm 1 is more efficient thanks to the subsidy.

In the unconstrained monopoly case, output and restructuring in firm 2 are the same as in the benchmark.

In the first stage, government 1 optimally chooses k_1. In case of duopoly welfare in country 1 is

$$W_{1s}(k_1) = P(x)x_1 - (c_1 - e_1 - k_1)x_1 - \frac{d}{2}e_1^2 - \frac{d}{2}k_1^2 + \alpha\int_0^{x^D}(P(x) - P(x^D))dx \tag{3.28}$$

and is assumed to be concave. The optimal k_1 is the one which nullifies the derivative of W_{1s} with respect to k_1:

$$x_1 + x_1\frac{\partial e_1}{\partial k_1} + x_1 P'(x)\frac{\partial x_2}{\partial k_1} - \alpha x P'(x)\frac{\partial x}{\partial k_1} = d(\frac{\partial e_1}{\partial k_1}e_1 + k_1). \tag{3.29}$$

The above equation shows all effects of the subsidy on welfare in country 1. The first term is the direct effect on the output in firm 1: marginal cost of production decreases so each unit of output brings higher revenue. The second term is the strategic effect on firm 1, due to which firm 1 restructures more by its own. This is a consequence of Proposition 1., since when the subsidy is positive, firm 1 has lower initial marginal cost. The third term is the strategic effect on the other firm (business-stealing effect). In reaction to a positive subsidy, firm 2's output decreases and firm 1 grabs a bigger market share. The

fourth term on the left-hand side of the equation reflects the price drop as the effect of the subsidy (competitive effect). The higher k_1, the lower the price, because total output increases. Summing up, as the result of the subsidy allocative efficiency is improved, but productive efficiency may be reduced due to the business-stealing effect. The term on the right-hand side is the marginal cost of restructuring and it consists of the subsidy cost which consumers have to pay, as well as the cost of additional restructuring induced by the subsidy.

If entry-deterrence is the equilibrium, the government chooses k_1 such that

$$W_{1s} = -\frac{d}{2}k_1^2 + \alpha \int_0^{x_2^E} (P(x) - P(x_2^E))dx \tag{3.30}$$

is maximized. Again, welfare function is assumed to be concave with respect to k_1. The first order condition is

$$\frac{\partial W_{1s}}{\partial k_1} = -\alpha x_2 P'(x_2)\frac{\partial x_2}{\partial k_1} - dk_1 = 0. \tag{3.31}$$

Since $P'(x)$ is assumed to be negative, and from (3.27) $\frac{\partial x_2}{\partial k_1}$ is positive, the derivative $\frac{\partial W_{1s}}{\partial k_1}$ evaluated in $k_1 = 0$ is positive. Since W_{1s} is concave, k_1 satisfying (3.31) must be positive. Therefore, in entry-deterrence the subsidy is positive. The government tries to bail the firm out, but the firm exits.

Proposition 3 (Failed Rescue) *If the equilibrium is entry-deterring monopoly of the more efficient firm, the R&R subsidy to the exiting firm is positive.*

Even when the less efficient firm exits for sure and the subsidy is nothing more than burning consumers' money, the government has a good reason to do it: the market is imperfectly competitive and the subsidy has a strategic effect on the efficient firm. This firm decreases the price so much, that even having paid for the subsidy, consumers in country 1 are better off. Consumers in country 2 gain even more, since they don't pay for the costly policy of government 1.

3.4.1 Linear Demand Example

For the sake of brevity, the following terms are defined:

$$f_1(\alpha) = 0.33359 + 0.0366975\alpha - 0.024098\sqrt{(\alpha - 28.168411)(\alpha + 0.50916)} \quad (3.32)$$

$$f_2(\alpha) = 0.5829 - 0.109912\alpha \quad (3.33)$$

$$f_3(\alpha) = 0.485749 + 0.10285\alpha + 0.062697\sqrt{(\alpha - 5)(\alpha - 0.35357)}$$
$$\text{for } \alpha \in (0, 0.3535) \quad (3.34)$$

$$f_4(\alpha) = 1 - 0.14907\sqrt{5 - \alpha} \quad (3.35)$$

$$f_5(\alpha) = 0.56271 + 0.02856\alpha - 1.38407\sqrt{\frac{(\alpha - 28.1684)^2(\alpha - 0.27334)}{153377 - 5445\alpha}}$$
$$\text{for } \alpha \in (0.27334, 1) \quad (3.36)$$

$$f_6(\alpha) = 0.47224 + 0.0467\alpha \quad (3.37)$$

$$m_4 = 0.52709 + 0.02982\alpha \quad m_5 = 0.532987 + 0.0934\alpha \quad (3.38)$$

The following proposition is proved in the Appendix:

Proposition 4 *Six different equilibrium outcomes emerge, depending on the parameters vector* (α, c_1).

1. *If condition* $0.4 < c_1 < \min[f_1(\alpha), f_6(\alpha)]$ *is fulfilled, entry-deterrence by firm 1 emerges in the equilibrium with strategies*

$$k_1^{E1} = c_1 - 0.229143 \quad e_1^{E1} = 0.12 \quad x_1^{E1} = 5e_1^{E1}. \quad (3.39)$$

2. *When* $f_1(\alpha) < c_1 < \min[m_4(\alpha), f_5(\alpha)]$, *duopoly emerges with strategies*

$$e_1^D = 4\frac{17 - 26(c_1 - k_1^D)}{451} \qquad x_1^D = \frac{15}{4}e_1^D \quad (3.40)$$

$$e_2^D = 4\frac{0.6 + 15(c_1 - k_1^D)}{451} \qquad x_2^D = \frac{15}{4}e_2^D \quad (3.41)$$

$$k_1^D = \frac{-0.804028 + 1.22969c_1 - 0.214158\alpha + 0.133849c_1\alpha}{0.133849\alpha - 3.77031}. \quad (3.42)$$

3. *If* $m_4(\alpha) < c_1 < \min[f_2(\alpha), f_3(\alpha)]$, *duopoly emerges as well, but the corner subsidy*

$$k_1^{Dc} = c_1 - 0.485749 \quad (3.43)$$

is chosen instead of k_1^D.

4. *For* $\max[f_2(\alpha), f_5(\alpha), f_6(\alpha)] < c_1 < m_5(\alpha)$*, entry-deterrence by firm 2 emerges:*

$$k_1^{E2c} = c_1 - 0.532987 \quad e_2^{E2} = \frac{1}{5}(1 - c_1 + k_1^{E2c}) \quad x_2^{E2} = 5e_2^{E2}. \tag{3.44}$$

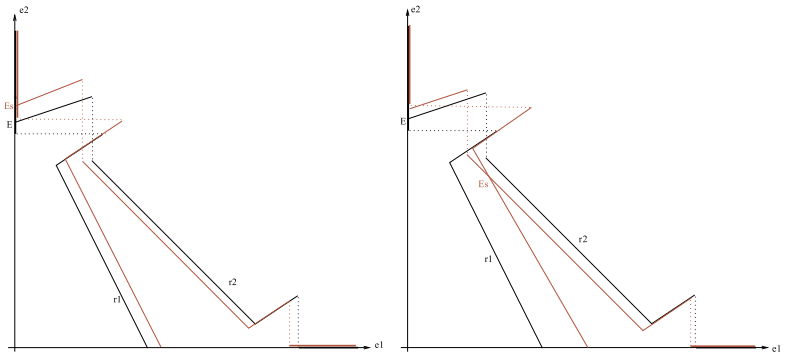
5. *If* $\max[f_3(\alpha), m_5(\alpha)] < c_1 < f_4(\alpha)$*, entry-deterrence by firm 2 emerges with strategies*

$$k_1^{E2} = \frac{\alpha(1-c_1)}{5-\alpha} \quad e_2^{E2} = \frac{1}{5}(1 - c_1 + k_1^{E2}) \quad x_2^{E2} = 5e_2^{E2}. \tag{3.45}$$

6. *Finally, for* $c_1 > f_4(\alpha)$*, firm 2 is a blockaded monopolist and the optimal subsidy is zero.*

How does the subsidy actually work? Figure 3.2 helps to develop some intuition. Reaction functions of the benchmark game are depicted in black and those of the subsidy game in red.

Figure 3.2: Reaction functions in a failed bailout and in a successful bailout.



(a) failed rescue (b) successful rescue

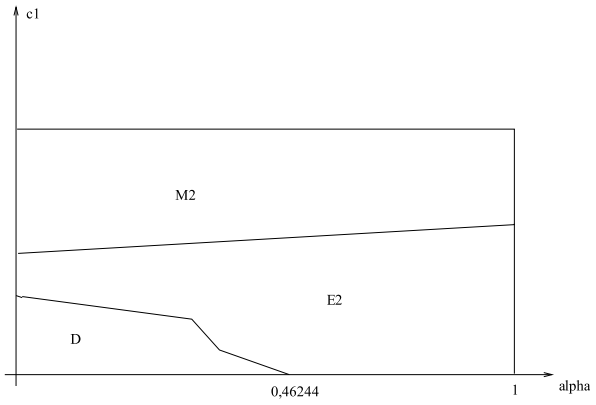
Figure 3.3(a) shows a failed rescue. The benchmark equilibrium is entry-deterring monopoly of firm 2, denoted by E. Due to the subsidy, equilibrium is moved to point Es, which is also the entry-deterring monopoly of firm 2, but with a higher restructuring level. Figure 3.3(b) illustrates a successful rescue: entry-deterrence equilibrium E changes into duopoly equilibrium Es, firm 1 is successfully rescued.

When $c_1 > \tilde{c_1}$, firm 1 exits in the equilibrium of the benchmark model and only then the subsidy is legal. Therefore, the subsidy equilibrium is analyzed for $c_1 > \tilde{c_1}$[9]. Figure 3.3 shows the location of each market structure in the (α, c_1) space.

A comparison of this outcome with the equilibrium in the benchmark case generates a few interesting observations. The first observation is a confirmation of the Proposition 3:

[9]The set $c_1 \in (\underline{c_1}, \tilde{c_1})$ is skipped due to the lack of pure strategy equilibrium in the benchmark.

Figure 3.3: Duopoly, entry-deterrence and monopoly in the (α, c_1) space.



k_1^{E2c} and k_1^{E2} are positive. In entry-deterrence of firm 2, the government still subsidizes firm 1 in order to achieve the desired strategic effect on firm 2. This effect consists of making firm 1 a little more efficient, so that firm 2 has to be more aggressive in cost-cutting to deter entry of firm 1. The result is a lower production cost and a lower price, which is beneficial for consumers in both countries.

The second observation is that duopoly is now more common: more parameter vectors result in duopoly. These vectors, which in the benchmark ended up with monopoly and with the subsidy lead to duopoly, guarantee a successful rescue. In these cases the original purpose of the subsidy is achieved: the less efficient firm is rescued from exit. Note that the lower α, the larger the set of c_1 which leads to successful rescue, while for $\alpha > 0.462443$ duopoly is not possible at all. That is because a big country has bigger incentives to subsidize an unsuccessful rescue: there are more consumers who gain from the decline of the price and are ready to pay for the subsidy. That implies that the strategic effect on the competing firm is stronger.

In the subsidy equilibrium there is less monopoly than in the benchmark. Entry-deterring monopoly of firm 2 is more beneficial to welfare in country 1 than blockaded monopoly of firm 2, so the government grants a subsidy in order to force firm 2 to deter entry.

The final remark is that the government's intervention allows the market to achieve pure-strategy equilibrium also for parameter vectors, for which pure-strategy equilibrium in the benchmark does not exist.

3.5 Welfare analysis

This section is devoted to the study of externalities of R&R subsidy on the welfare distribution under the assumption of linear demand. The subsidy is positive in case of successful rescue, which happens for parameter vectors (α, c_1) such that $\tilde{c_1} < c_1 < h(c_1)$, and for failed rescue which happens for parameter vectors (α, c_1) such that $h(c_1) < c_1 < f_4$, where

$$h(c_1) = \begin{cases} f_3 & for \quad \alpha \in (0, 0.24562), \\ f_2 & for \quad \alpha \in (0.24562, 0.399563), \\ f_5 & for \quad \alpha \in (0.399563, 0.462443), \\ \tilde{c_1} & for \quad \alpha \in (0.462443, 1). \end{cases} \tag{3.46}$$

The comparison of prices leads to the following

Corollary 1 *Compared with the benchmark equilibrium price, the subsidy equilibrium price increases in successful rescue, but decreases in failed rescue.*

In case of successful rescue, duopoly is the outcome. The high-cost firm also produces, which drives the average production cost up. As the result, the price is higher compared with the benchmark and all consumers lose. Consumers in country 1 lose even more than those in country 2, because they additionally have to pay for the subsidy. The gain in firm 1's profit, however, is high enough, so that country 1's welfare is increased. In failed rescue, entry-deterrence of firm 2 is the outcome. The price is then $P(x_2^{Es}) = c_1 - k_1$ and since the subsidy is positive, it is lower then c_1, which is the price in entry-deterrence in the benchmark. Entry-deterrence price $P(x_2^{Es})$ is also lower than the unconstrained monopoly price, which is the highest of all prices.

The comparison of profits leads to the following

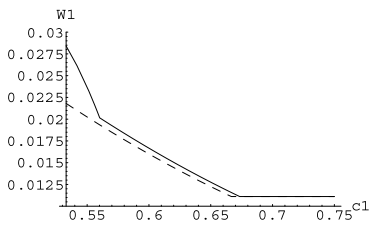
Corollary 2 *Total industry profits decrease in both successful and in failed rescue.*

If the rescue fails, firm 2 has to restructure more aggressively in order to keep firm 1 out of the market. Therefore, its profits are lower than in the benchmark case. In successful rescue, total profit and profit of firm 2 decrease, since firm 2 restructures less than in the benchmark and the mark-up of the bailed-out firm is small due to high production cost.

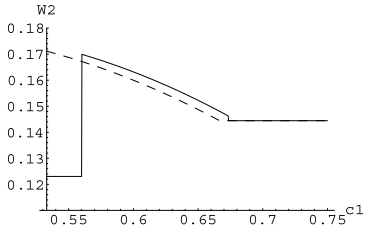
An example of welfare changes is depicted in Figures 3.4 and 3.5. All parts of welfare are presented as a function of c_1, holding α fixed at two different levels. Dashed lines represent the benchmark model, while continuous lines illustrate the subsidy game.

The following regularities emerge. Country 1 is always better off. In successful rescue it gains on profit, in a failed rescue it gains on consumer surplus. This is a consequence of the game construction: government 1 acts as the first player and by setting $k_1 = 0$ she

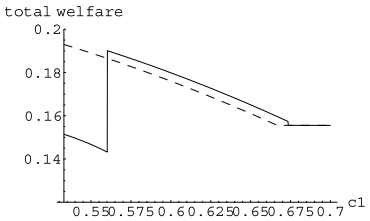
Figure 3.4: Effects of the subsidy for $\alpha = 0.2$.



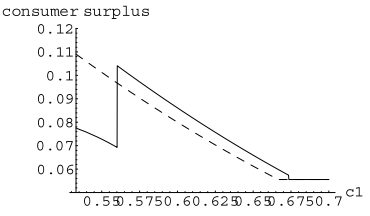
(a) welfare 1



(b) welfare 2

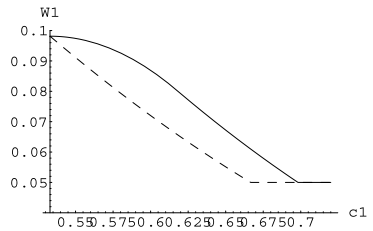


(c) total welfare

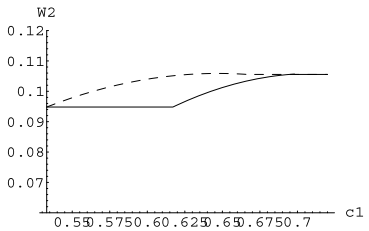


(d) net consumer surplus

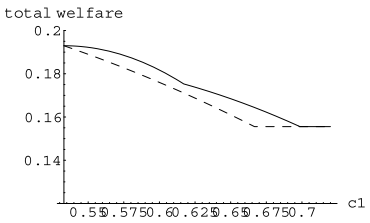
Figure 3.5: Effects of the subsidy for $\alpha = 0.85$.



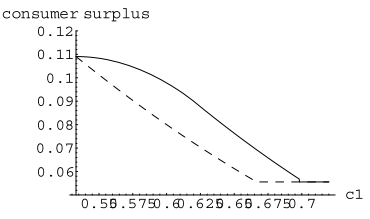
(a) welfare 1



(b) welfare 2



(c) total welfare



(d) net consumer surplus

can always get at least the benchmark welfare. Therefore in the subsidy game she can do better.

Welfare in country 2 increases when consumer surplus increases a lot and country 2's share in consumer surplus in very high. That is the case for the failed rescue and low α. In a successful rescue consumers are harmed and firm 2 loses market share, so welfare in that case decreases compared with the benchmark. Also when α is high enough, welfare declines since entry-deterring profits are lower and a big part of consumer gain belongs to country 1.

The change in total welfare is a sum of the above two. In case of the successful rescue total welfare drops and this drop is caused mainly by smaller consumer surplus and higher total production cost. In the failed rescue total welfare increases, since the subsidy enforces a lower price and the cost of the subsidy is low enough to make such rescue profitable for consumers.

3.6 Conclusions

Summing up, the results show that depending on the initial cost asymmetry between firms and the asymmetry in countries' share in consumer surplus, a bailout has one of the following effects: it can save the high-cost firm from the exit and in this way reduce productive and allocative efficiencies in the common market, or it can have a strategic impact on the entry-deterring monopolist and in this way increase allocative efficiency, without preventing exit of the beneficiary.

Moreover, the asymmetry in size is very important: countries with equally inefficient firms, but different shares in consumer surplus, choose very different policies. Roughly speaking, big countries prefer not to prevent exit, while small countries prefer to do it.

In the airlines industry, governments of several small countries tried to prevent exit of their national champions, e.g. the Greek government granted rescue aid to Olympic Airways and very recently the Commission approved a bailout of Cyprus Airways. These rescues were successful in the bailout, but were likely to keep prices high. The situation could be different in case of the Italian government's subsidy for Alitalia. It is still not sure if the exit was prevented, but if Alitalia exits, welfare in both Italy and the whole EC may increase due to lower prices, which come about because other airlines restructure more in the presence of a subsidy, than they would in its absence.

In this paper, subsidies which actually succeed in the rescue decrease welfare of all consumers and total welfare. Only the rescued firm benefits. Such negative externality on welfare in other countries, in the absence of objectives other than economic efficiency, this can be a reason to ban them. On the other hand, subsidies which fail to rescue are

welfare improving. Their aim is purely to distort free market, but to the advantage of consumers.

The most important limitations of the model are: lack of dynamics, ignored shadow cost of taxation and the assumption of benevolent governments. The dynamics could allow to study soft-budget constraints, leading to further welfare reduction in case of successful rescues. Shadow cost of taxation would work in the same direction. Finally, if governments have other objectives than welfare when rescuing a firm, e.g. sustaining jobs, reelection or bribes, optimal bailout policy will be different.

3.7 Appendix

3.7.1 Proof of Proposition 2.

2nd stage: production

In the second stage of the game, the levels of restructuring are already chosen and firms choose their preferred level of production. In a Nash equilibrium, each firm optimizes its profits assuming that output of the other firm is constant. There are five potential market structures: firm 1 or 2 can be a blockaded monopoly, each can deter entry or finally both firms can produce in duopoly.

Suppose first that firm 2 is more efficient: $0.4 - e_2 < c_1 - e_1$. Monopoly of firm 2 emerges if the best-reply of firm 1 is not to enter, that is when the monopoly price is lower than marginal cost in firm 1:

$$1 - x_2^M < c_1 - e_1 \tag{3.47}$$

Since $x_2^M = \frac{1-(0.4-e_2)}{2}$, (3.47) reduces to

$$e_2 > 1.4 - 2(c_1 - e_1) = l_1(e_1) \tag{3.48}$$

Duopoly is the equilibrium if firm 2's duopoly profits are higher than entry-deterrence profits, which can be reduced to

$$e_2 < 0.65 - \frac{5}{4}(c_1 - e_1) = l_2(e_1) \tag{3.49}$$

Otherwise, entry-deterrence by firm 2 is the equilibrium.

Suppose now that firm 1 is more efficient: $e_2 < 0.4 - c_1 + e_1 = l_3(e_1)$. By symmetric

reasoning, duopoly will emerge if

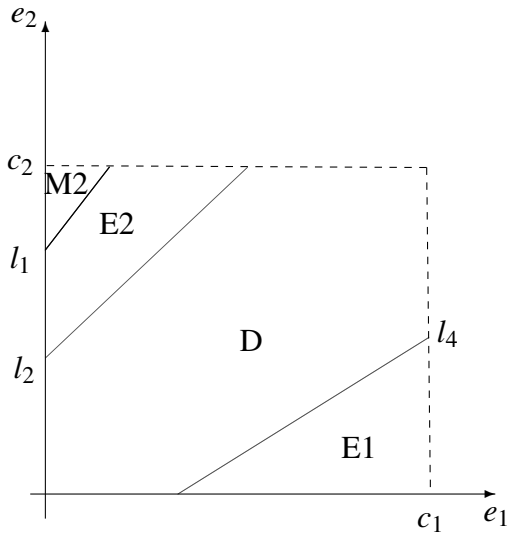
$$e_2 > 0.2 - \frac{4}{5}(c_1 - e_1) = l_4(e_1) \tag{3.50}$$

and monopoly if

$$e_2 < -0.1 - \frac{1}{2}(c_1 - e_1) = l_5(e_1) \tag{3.51}$$

However, l_5 is never binding since it is located outside of the rectangle $\mathscr{C} = (0, c_1) \times (0, c_2)$, in which restructuring efforts must fit according to the assumptions. It is a consequence of fixing c_2 low enough.

Figure 3.6: Four market structures emerge in the equilibrium of the second stage of the benchmark game.



In the M2 area, firm 2 is the monopolist, in the E2 area firm 2 deters entry of firm 1, in the D area both firms compete and in the E1 area firm 1 deters entry of firm 2.

1st stage: restructuring

Knowing the equilibrium outcome of the second stage, firms choose restructuring levels: $e_i \in (0, c_i)$. Profits of firms are

$$\Pi_2 = \begin{cases} 0 & \text{if } (e_1, e_2) \in E1 \\ \frac{1}{9}[1 - 2(0.4 - e_2) + (c_1 - e_1)]^2 - \frac{5}{2}e_2^2 & \text{if } (e_1, e_2) \in D \\ [(c_1 - e_1) - (0.4 - e_2)](a - c_1 + e_1) - \frac{5}{2}e_2^2 & \text{if } (e_1, e_2) \in E2 \\ \frac{1}{4}[1 - (0.4 - e_2)]^2 - \frac{5}{2}e_2^2 & \text{if } (e_1, e_2) \in M2 \end{cases} \tag{3.52}$$

and symmetrically

$$\Pi_1 = \begin{cases} 0 & \text{if } (e_1, e_2) \in M2 \text{ or } E2 \\ \frac{1}{9}[1 - 2(c_1 - e_1) + (0.4 - e_2)]^2 - \frac{5}{2}e_1^2 & \text{if } (e_1, e_2) \in D \\ [(0.4 - e_2) - (c_1 - e_1)](1 - (0.4 - e_2) - \frac{5}{2}e_1^2 & \text{if } (e_1, e_2) \in E1 \end{cases} \tag{3.53}$$

The location of the reaction functions depends on the value of $c_1 \in (0.4, 1)$. I start with the locating best-reply in each market structure separately by solving the first order conditions. This is sufficient, since for $d = 5$ all profit functions Π_i are concave in e_i. Then I compare profits across market structures for a given e_j, taking into account possible corner solutions, and in this way I identify reaction functions.

In monopoly, the best-reply function is independent of the rival's restructuring:

$$e_i^M = \frac{1 - c_i}{9} \quad \Pi_i^M = \frac{5(1 - c_i)^2}{18} \tag{3.54}$$

Monopoly of firm 2 is possible when area M2 overlaps the rectangle $\mathscr{C}$, like in the Figure 3.6. That happens when l_1 intersects $e_2 = 0.4$ for positive e_1, which is equivalent to $c_1 > 0.5$. Best-reply e_2^M overlaps area M2 for $e_1 \in (0, c_1 - 0.6667)$. Otherwise, e_i^M is located below l_1, so the best-reply in monopoly is a corner solution which for a given e_1 is closest to e_2^M and that is $e_2 = l_1(e_1)$.

In entry-deterrence, the best-reply function does depend on the rival's restructuring:

$$e_i^E = \frac{1 - (c_j - e_j)}{5} \quad \Pi_i^E = \frac{1 - (c_j - e_j)}{10}[1 - 10c_i + 9(c_j - e_j)] \tag{3.55}$$

e_2^E always cuts l_1 in the same point as e_2^M and it cuts l_2 for $e_1 = c_1 - 0.428571$. Therefore, for $e_1 > c_1 - 0.428571$, the highest profit in entry-deterrence brings a corner solution $e_2 = l_2$ and for $e_1 < c_1 - 0.66667$ a corner solution $e_2 = l_1$.

Finally, the best-reply function in duopoly:

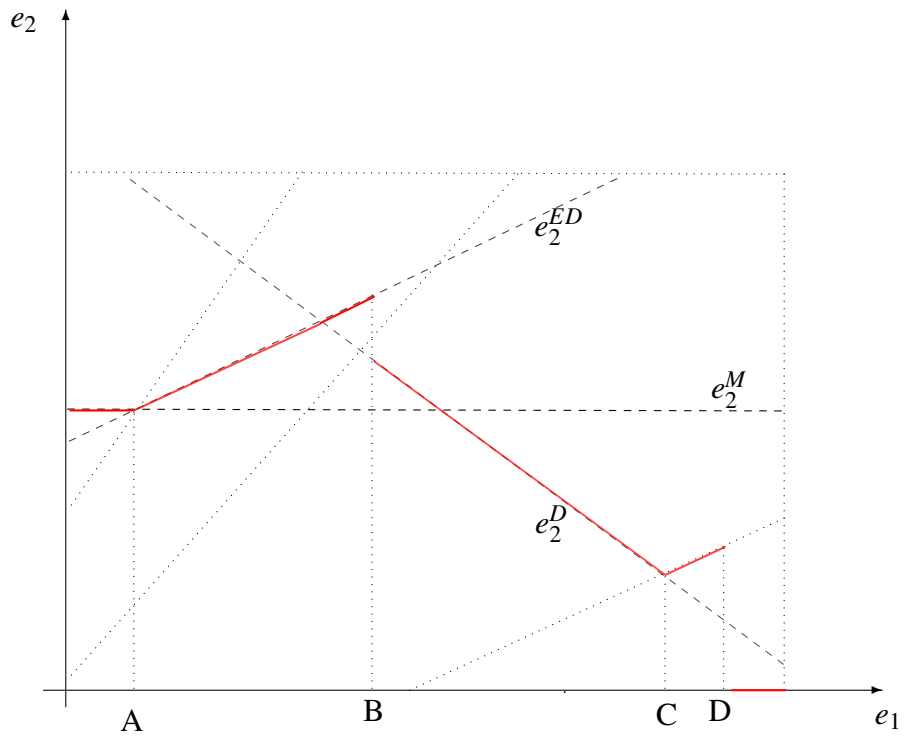
$$e_i^D = \frac{4}{37}[1-2c_i+c_j-e_j] \quad \Pi_i^D = \frac{5}{37}[1-2c_i+c_j-e_j]^2 \tag{3.56}$$

e_2^D cuts l_2 for $e_1 = c_1 - 0.462687$ and for lower e_1 the highest duopoly profit available can be achieved by $e_2 = l_2$. e_2^D cuts l_4 for $e_1 = c_1 - 0.196429$ and for higher e_1 the highest duopoly profit can be achieved by $e_2 = l_4$.

When the rival deters entry or is the unconstrained monopolist, best-reply is not to restructure at all, since it generates no revenue, but costs.

Finally, the reaction function of firm 2 are found: the best reply which brings the highest payoff to firm 2 for a given e_1. For $e_1 < c_1 - 0.6667$, which in figure 3.7 is denoted by letter A, it is necessarily e_2^M. Next, I compare π_2^E with monopoly profit on l_1 to conclude that firm 2 always prefers to deter entry. Next, I compare optimal entry-deterrence profit π_2^E with optimal duopoly profit π_2^D. Duopoly is more profitable for $e_1 > c_1 - 0.446986$, denoted below as B. For $e_1 = c_1 - 0.196429$ (point C in figure 3.7), e_2^D cuts l_4. For higher e_1 the highest duopoly profit for firm 2 is for $e_2 = l_4$. It is the best-reply if it is positive and that happens for e_1 between points C and D. Firm 2's reaction function is depicted in red in Figure 3.7.

Figure 3.7: Reaction function of the efficient firm.

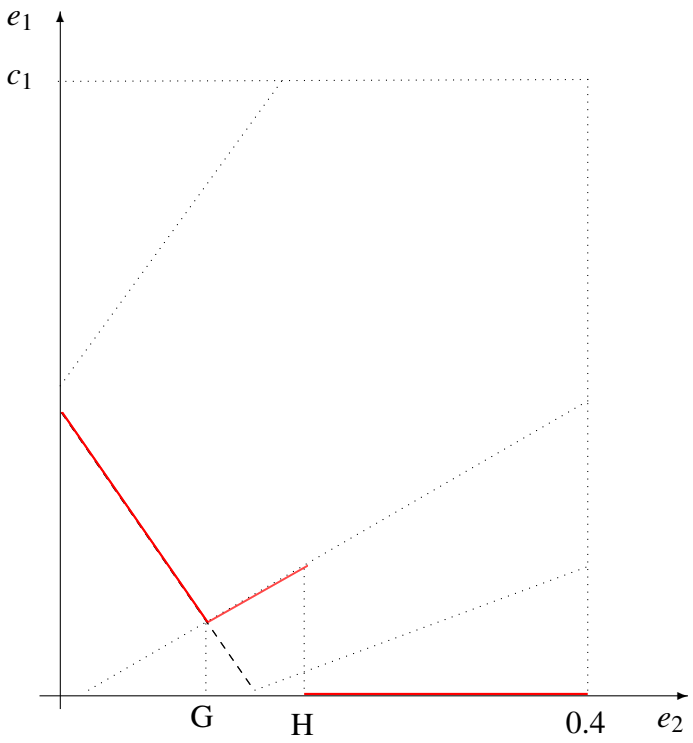


The reaction function of the inefficient firm is found in a similar way. Monopoly is

never possible here. e_1^E never intersects area E1, so the best-reply in entry-deterrence is always a corner solution $e_1 = l_4^{-1}(e_2)$. In duopoly, the best-reply is e_1^D for $e_2 < 0.739286 - 1.33929c_1 = G$ and $l_2^{-1}(e_1)$ otherwise. E is positive when $c_1 < 0.552$.

In order to find firm 1's final reaction function I first compare entry-deterrence profit in the corner solution $e_1 = l_4^{-1}$ with optimal duopoly profits and I find that duopoly is always better. And finally, I check when duopoly profit is positive on l_2^{-1}. That happens for $e_2 < 0.88476 - 1.48476c_1 = H$, with H positive if $c_1 < 0.5958$. Otherwise, best reply of firm 1 is $e_1 = 0$. The reaction function is depicted in red in Figure 3.8.

Figure 3.8: Reaction function of the inefficient firm.



The intersection of the reaction functions gives the equilibrium. If $c_1 > 0.5958$, H is negative and firm 1 always prefers not to restructure. If additionally $c_1 > 0.6667 = \overline{c_1}$, firm 2 is a monopolist, and for $c_1 \in (0.5958, 0.6667)$ it deters entry of firm 1.

For $c_1 \in (0.55, 0.5958)$ G is negative, but H positive. Firm 1 undertakes suboptimal duopoly restructuring or no restructuring. No restructuring reaction always cuts e_2^{ED} in this c_1 range, so the outcome here is also entry-deterrence. Down to $c_1 = 0.532987 = \tilde{c_1}$ the situation is the same, since then $H < e_2^{ED}(e_1 = 0)$ For $c_1 < 0.485749 = \underline{c_1}$, duopoly best-replies intersect in D, so the outcome is duopoly. For $c_1 \in (\underline{c_1}, \tilde{c_1})$ reaction functions do not intersect (intersect in the point of discontinuity, perhaps mixed strategy equilibrium there).

3.7.2 Proof of Proposition 4.

Note that the last two stages of the game are the same as in the benchmark case, with the only difference that firm 1's initial marginal cost is $c_1 - k_1$. A positive k_1 moves reaction function e_2^D down, while pushing e_2^E and e_1^D up in the (e_1, e_2) space. The lines l_1, l_2 and l_4 dividing the $\mathscr{C}$ area are all pushed upwards, too:

$$l_{1s} = 1.4 - 2(c_1 - k_1 - e_1) \tag{3.57}$$

$$l_{2s}(e_1) = 0.65 - \frac{5}{4}(c_1 - k_1 - e_1) \tag{3.58}$$

$$l_{4s}(e_1) = 0.2 - \frac{4}{5}(c_1 - k_1 - e_1) \tag{3.59}$$

l_{5s} is still located outside of $\mathscr{C}$.

Best-reply function of firm 2 does not change except for replacing c_1 with $c_1 - k_1$, compared with Proposition 2. Best-reply function of firm 1 becomes more interesting, because now marginal cost $c_1 - k_1$ may be also lower than 0.4.

Monopoly of firm 1 is excluded by the low choice of c_2, but entry-deterring reaction of firm 1 is now possible. Using the algorithm from the previous proof, I find that e_1^{Es} is best-reply for firm 1 when $e_2 < 0.32169 - 0.92169(c_1 - k1)$. For $0.32169 - 0.92169(c_1 - k1) < e_2 < 0.739286 - 1.33929(c_1 - k_1)$ best-reply is e_1^{Ds}. For $0.739286 - 1.33929(c_1 - k_1) < e_2 < 0.884761 - 1.48476(c_1 - k_1)$, the best-reply function is a part of the l_2 line, and for even higher e_2 it is best for firm 1 not to restructure at all.

The next step in the proof is to find the equilibrium in the second stage of the game, which is where the two best-replies cross. Analogously to the previous proof, monopoly of firm 2 emerges when $c_1 - k_1 > 0.6667$ and entry-monopoly of firm 2 when $0.6667 > c_1 - k_1 > 0.532987$. Duopoly is the equilibrium when both duopoly reaction functions cross in the D area and this time e_1^{Ds} is longer than in the benchmark, so duopoly emerges for $0.485749 > c_1 - k_1 > 0.299953$. Finally, entry-deterrence by firm 1 emerges if $c_1 - k_1 < 0.229143$.

1st stage: subsidy

The first stage of the game is the choice of the optimal subsidy. Government 1 knows what will happen in the later two stages. Welfare in country 1 is a piecewise-defined function, depending on the value of k_1. For some values of c_1 in the benchmark model, pure strategy equilibrium does not exist and then it is assumed to equal to zero. First, welfare for each market structure is calculated separately.

When

$$c_1 - 0.229143 < k_1 < c_1 \tag{3.60}$$

reaction functions cut each other where firm 1 deters entry and firm 2 exits. Welfare in country 1 is

$$W_{1s}^{E1} = \pi_1^{E1} + \alpha CS^{E1} - \frac{5}{2}k_1^2 = 0.275999 - 0.6c_1 + 0.6k_1 - 2.5k_1^2 + 0.18\alpha \tag{3.61}$$

and it is maximized for

$$k_1^{E1} = 0.12 \tag{3.62}$$

which is independent of any parameter and fulfils condition (3.60) when

$$m_1 = 0.12 < c_1 < 0.349143 = m_2. \tag{3.63}$$

Since $c_1 > 0.4$ by assumption, it is always the case that $k_1^{E1} < c_1 - 0.229143$. Therefore the government will always choose a corner solution $k_1^{E1c} = c_1 - 0.229143$, with welfare denoted by a star

$$W_1^{E1*} = 0.0072479 + 1.145715c_1 - 2.5c_1^2 + 0.18\alpha. \tag{3.64}$$

Duopoly is the outcome if

$$c_1 - \underline{c_1} < k_1 < c_1 - 0.299953. \tag{3.65}$$

Welfare of country 1 is then equal to

$$W_{1s}^{D} = \pi_1^{D} + \alpha CS^{D} - \frac{5}{2}k_1^2 = \tag{3.66}$$
$$= k_1^2(-1.885155 + 0.06692\alpha) + k_1[c_1(-1.229689 - 0.133849\alpha) + (0.80402 + 0.21416\alpha)]$$
$$+0.171326\alpha + 0.262855 + c_1(-0.804027 - 0.214158\alpha) + c_1^2(0.614844 + 0.0669\alpha)$$

Optimal subsidy in this case is

$$k_1^D = \frac{-0.804028 + 1.22969c_1 - 0.214158\alpha + 0.133849c_1\alpha}{0.133849\alpha - 3.77031} \tag{3.67}$$

and it fulfils condition (3.65) when

$$m_3 = 0.38698 + 0.034802\alpha < c_1 < 0.52709 + 0.029828\alpha = m_4 \tag{3.68}$$

In this range the government can choose the peak of the welfare parabola and otherwise corner solutions emerge. For $\alpha < 0.373931$, I have $m_3 < 0.4$, so in this range of α the lower boundary on c_1 is 0.4.

Entry-deterring monopoly of firm 2 emerges when

$$c_1 - \overline{c_1} < k_1 < c_1 - \tilde{c_1}. \tag{3.69}$$

Welfare in country 1 is then

$$W_{1s}^{E2} = -\frac{5}{2}k_1^2 + \frac{1}{2}\alpha(1 - c_1 + k_1)^2 \tag{3.70}$$

and optimal k_1 -the one which fulfils first order condition- is here

$$k_1^{E2} = \frac{\alpha(1-c_1)}{5-\alpha} \tag{3.71}$$

This optimal subsidy fulfils condition (3.69) when

$$m_5 = 0.532987 + 0.0934\alpha < c_1 < 0.6667 + 0.06666\alpha = m_6 \tag{3.72}$$

Again, in this range the peak of the welfare parabola and otherwise a corner solution is chosen.

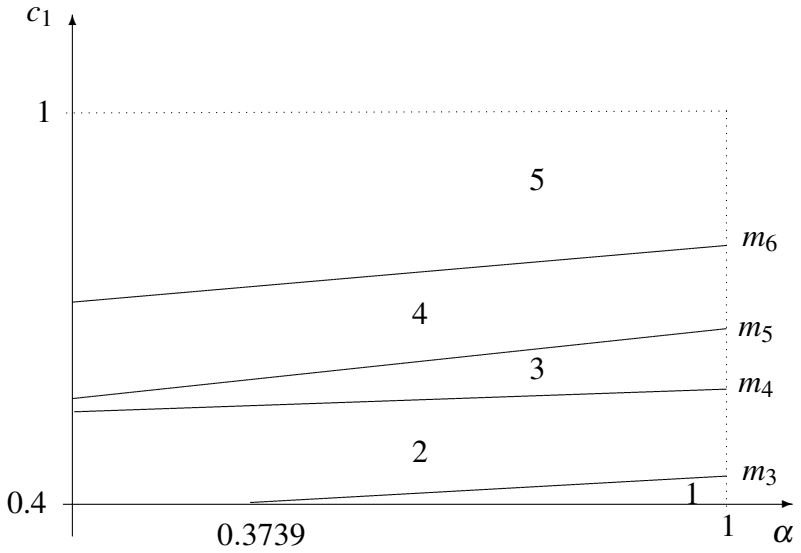
Finally, $0 < k_1 < c_1 - \overline{c_1}$ equilibrium market structure is a blockaded monopoly with welfare $W_{1s}^{M2} = 0.0555556\alpha$ independent of k_1.

The government chooses $k_1 \in [0, c_1]$ depending on α and c_1. Plotting the lines m_3, m_4, m_5, m_6 and $c_1 = 0.4$ in the (α, c_1) space (Figure 3.9) reveals that there are five cases to consider.

- The first case is for $0.4 < c_1 < m_3$, it is possible only for $\alpha > 0.3739$. Here, the government has a choice between W_1^{E1*}, $W_1^D(k_1 = c_1 - 0.299953)$, $W_1^{E2}(k_1 = c_1 - \tilde{c_1})$ and monopoly welfare W_1^{M2}. Simple calculation shows that W_1^{E1*} is always the highest, so this is the optimal choice of the government.

- The second case is for $m_3 < c_1 < m_4$. Here, optimal duopoly choice is possible. The government compares W_1^{E1*} with $W_1^D(k_1^D)$, $W_1^{E2}(k_1 = c_1 - \tilde{c_1})$ and W_1^{M2} and

Figure 3.9: Government has five different cases to consider.



finds that W_1^{E1*} is the highest for $c_1 < \min[f_1(\alpha), f_6(\alpha)]$ where

$$f_1 = 0.33359 + 0.0366975\alpha - 0.024098\sqrt{(\alpha - 28.168411)(0.50916 + \alpha)}$$
$$f_6 = 0.47224 + 0.0467012\alpha$$

Duopoly generates highest welfare for $f_1(\alpha) < c_1 < \min[m_4(\alpha), f_6(\alpha)]$ and entry-deterrence by firm 2 is the best for $\max[f_5, f_6] < c_1 < m_4$, where

$$f_5(\alpha) = 0.56271 + 0.02856\alpha - 1.38407\sqrt{\frac{(\alpha - 28.1684)^2(\alpha - 0.27334)}{153377 - 5445\alpha}}$$
$$\text{for } \alpha \in (0.27334, 1)$$

- The third case is for $m_4 < c_1 < m_5$. Here, the government chooses the highest of W_1^{E1*}, $W_1^D(k_1 = c_1 - \underline{c_1})$, $W_1^{E2}(k_1 = c_1 - \tilde{c_1})$ and W_1^{M2}. It is easy to check that $W_1^D(k_1 = c_1 - \underline{c_1}) < W_1^{E2}(k_1 = c_1 - \tilde{c_1})$ when

$$c_1 > 0.5829 - 0.109912\alpha = f_2.$$

The line f_2 divides the area into two parts. To the right of it, the government will choose such k_1 which will lead to entry-deterrence by firm 2. To the left, there is duopoly.

- The fourth case is for $m_5 < c_1 < m_6$. Here k_1^{E2} is available. The government compares W_1^{E1*}, $W_1^D(k_1 = c_1 - \underline{c_1})$, $W_1^{E2}(k_1^{E2})$ and W_1^{M2} and chooses duopoly if

$\alpha < 0.35357$ and

$$c_1 < 0.485749 + +0.10285\alpha + 0.062697\sqrt{(\alpha - 5)(\alpha - 0.35357)} = f_3$$

or monopoly of firm 2 if

$$c_1 > 1 - 0.14907\sqrt{5 - \alpha} = f_4$$

- The final case is for $m_6 < c_1 < 1$. Here the government chooses the highest of W_1^{E1*}, $W_1^D(k_1 = c_1 - \underline{c_1})$, $W_1^{E2}(k_1 = c_1 - \overline{c_1})$ and W_1^{M2}. For such a high c_1, it is always most profitable not to subsidize and achieve W_1^{M2}.

Proposition 4 summarizes the choices of the government for all ranges of c_1.

Chapter 4

Political economics of bailouts

4.1 Introduction

Bailouts in the European Union have been investigated by the European Commission as a part of state aid control process since 1995. To rescue a firm, governments of member states need to get an approval of the Commission. During the years 1995-2003, a great heterogeneity in the number of approved bailout cases can be observed across countries (Głowicka, 2006):

Table 4.1: Number of bailouts per country.

Country	No of cases	Country	No of cases	Country	No of cases
Austria	6	Germany	26	Netherlands	2
Belgium	4	Greece	1	Portugal	5
Denmark	0	Italy	16	Spain	10
France	12	Ireland	0	Sweden	0
Finland	0	Luxembourg	0	UK	4

The objective of this paper is to find determinants of the strong variation in bailout policies.

What factors should be considered when explaining bailout policy? Anecdotal evidence suggests that bailouts are used by politicians for political objectives. For example, the poll scores of German chancellor Gerhardt Schröder peaked from an abnormally low level after his decision to bail out a large construction firm Philipp Holzmann in 1999. The title page of the *Tageszeitung* on the day after the decision was: *"Holzmann bails out Schröder"*,[1] suggesting that it was actually Schröder's political career which was bailed out. Systematic empirical evidence provided by Neven and Röller (2000) confirms significance of political factors in the allocation of state aid in the EU: 90% of variation in total

[1] Own translation. Original title: "Holzmann saniert Schröder", Tageszeitung, November 26, 1999.

state aid granted to manufacturing sector across member states can be explained with a few political economy variables. Therefore, political variables are expected to play the key role in determining bailout policy.

Institutions are another factor relevant for bailout policy. Persson and Tabellini (2000, 2003) develop a theory and provide evidence of the causal impact of electoral rules and forms of government on economic policy. They predict that targeted fiscal policies are more likely to be used in countries with majoritarian electoral systems, since elections in those countries are often reduced to a heated fight in a few districts with swing voters. Therefore politicians have incentives to choose policies targeted to voters from those regions. The division of powers between different levels of governments and institutions is also likely to influence bailout decisions, since it reflects the distribution of decision rights among bureaucrats and local and central politicians (Lijphart, 1999).

Last but not least, differences in the economies of countries might explain variation in bailouts. Relevant economic factors concern the mere existence of firms in trouble, as well as their ability to extract rents. Differences in economy size, phase in business cycle, share of declining industries in the country's economy or effectiveness of bankruptcy law all result in different number of insolvent firms and therefore different "demand" for a bailout. In each particular firm, active unions and intensive lobbying can help to extract a subsidy. High unemployment or poor living standards might justify a bailout from a social point of view.

This paper explains bailout policies in the EU by political, institutional and economic factors. The data set covers all bailouts approved by the Commission in the EU of 15 member states between 1995 and 2003. Bailouts are a unique type of government expenditure: targeted to particular firms and observed across EU countries. This creates an opportunity to exploit cross-country and time-series variation in institutional, political and economic variables to draw inference of determinants of a targeted fiscal policy. Even though EU countries are strong and old democracies and have the best institutions in the world, several interesting results survive robustness checks.

The main result of the paper is the finding that the more majoritarian democratic institutions in the country, the more likely bailouts are. In addition, in majoritarian countries bailouts are more likely during years preceding elections. Both results suggest that bailouts are used by some governments as pork-barrel to improve their reelection chances. This finding is consistent with theoretical predictions of Persson and Tabellini (2000) and empirical evidence for several targeted fiscal policies within countries (Strömberg, 2004; Cadot et al., 2006).

Another result is that the more federal the country in the division of powers, the more likely the bailouts. An explanation of this finding is not obvious. One possibility is that

in federal countries bailouts are used as pork-barrel not only in central but also in local elections, so the frequency of bailouts is larger. Another reason could be asymmetric information of local politicians vs central ones: local politicians are closer to people and so may have better information about the needs of the economy and the society. They might also be more accessible to firms and therefore easier to bribe.

Political strength of governments also matters for bailout decisions. On average, one-party governments bailed out more frequently than coalition governments. Moreover, the more seats in the lower house of the legislature supporting the government, the more likely bailouts. This result is consistent with Tsebelis (2002), in that the more veto players in the political system, the more difficult it is to make decisions.

The results fill in the gap in existing evidence on the link between institutions and economic outcomes. To the best of my knowledge, the relationship between the electoral rules and targeted public spending was not tested empirically before. The likely reason is a difficulty in finding a targeted fiscal policy which can be observed across countries. I believe that European bailouts are a perfect object for this exercise. Furthermore, my result on electoral cycles contrasts with papers showing that elections-related rises of state aid exist in weak democracies, but not in EU15 (Dinç, 2005; Neven and Röller, 2000). Finally, this paper contributes to the debate on the actual impact of political institutions on economic outcomes, which is often put into question due to the likely endogeneity of the two variables (see Glaeser et al. (2004)). Here institutions matter, yet it is highly unlikely that bailout policy has any significant effect on the choice of institutions simply because it has a limited impact on the society overall. In case of particular policy choices, institutions influence incentives of politicians to pick a certain policy (Börner, 2005). This paper shows that bailout policy in the EU is not an exception to this rule.

4.2 Theory and Predictions

Political economics literature has flourished in the last decade. Surveys focusing on different aspects of this literature can be found in Franzese (2002a), Djankov et al. (2003), Persson and Tabellini (2004) and Börner (2005). I introduce in more detail a specific stream of this literature: political and institutional determinants of targeted public policies.

Electoral Rules

Electoral rules have three elements: voting district size, the formula translating votes into seats and ballot structure. All three are strongly correlated, leading to a common classification into three groups: majoritarian, proportional and mixed. The pure majoritarian rule

combines the plurality formula (the winner takes all) with single-seat districts. The pure proportional rule grants the seats to parties proportionally to the total number of votes in the district and the district is the whole country. In the third group, the electoral rule is a mixture of the two extremes. Among the EU15 countries, France and the UK have classical plurality voting systems, while the Netherlands a classical proportional system. In Germany and Italy, a part of the lower house is elected in plurality voting and another part in proportional voting. The remaining countries have proportional electoral rules.

Theory predicts that compared to countries with proportional electoral rules, governments in countries with majoritarian rules have incentives to choose policies targeted to small groups rather than broad redistribution policies addressed to all voters. The intuition for this prediction is very simple: in those countries swing voters are easier to identify and target. Districts are usually defined geographically. In addition, politicians can be sure of support in some districts, while there are few and well known districts where competition for the seat is heated. In order to increase their winning chances, politicians have incentives to chose policies benefiting voters from those districts and not necessarily the rest of voters. As the result, interests of voters from different districts are not equally represented. On the other hand, in proportional systems the proportion of seats awarded to a political party is equal to the proportion of votes the party gets in the elections. This creates incentives to choose policies which target as broad coalition of voters as possible, e.g. through broad redistributive welfare state programs or universal public goods. Persson and Tabellini (2000) and Lizzeri and Persico (2001) derive this prediction in electoral competition models with binding electoral promises and Milesi-Ferretti et al. (2002) in a model where a coalitional government chooses policies maximizing joint utility of its members.

Several empirical studies found evidence for systematic differences in the composition of public spending between majoritarian and proportional democracies, both in cross-sectional and panel data analysis. The effect of electoral system remains statistically significant even when controlling for other variables determining the composition of government spending: the percentage of young and elderly in the population, per capita income, the age and quality of democracy, openness in trade, etc. Milesi-Ferretti et al. (2002) examine the relationship between electoral systems and composition of fiscal policy in 20 OECD and 20 Latin America countries. They show that proportional systems spend more on transfers addressed to large social groups than majoritarian systems. What is more, in OECD countries (but not in Latin America countries) this effect exists even within proportional systems only: the higher the degree of proportionality of the electoral rule, the higher broad transfers. Persson and Tabellini (2003) and Persson and Tabellini (2004) look at 70 democracies and control for self-selection of countries into electoral

systems. According to their estimates, countries with proportional systems have about 2% larger welfare spending than countries with majoritarian systems.

All the above papers provide evidence on higher broad redistributive public expenditure in proportional systems. Evidence showing the other piece of the puzzle - higher targeted public expenditure in majoritarian system is to the best of my knowledge not available. Since there is some evidence that the total public expenditure is higher in proportional systems (Persson and Tabellini, 2004), this question is of great interest. The reason why it was not examined before is likely to be that a well defined and common for many countries targeted public expenditure is difficult to find. I believe the European bailout control provides such a policy tool: bailouts large enough to be under the obligation of notification to the European Commission. A firm in difficulty is well defined, its employees are people with names and its location is usually geographically limited, therefore bailouts are a particular targeted fiscal policy decision. In the light of the above literature, one should expect more bailouts in countries with majoritarian electoral rules than in those with proportional systems. Therefore, the first hypothesis I put forward to test in the data is: bailouts are the more likely, the more majoritarian electoral system in the country.

Electoral Cycles

Proximity of elections induces politicians to undertake projects or choose policies they would not choose otherwise. Franzese (2002a) surveys the literature on macroeconomic electoral cycles. However, electoral cycles can be observed also in microeconomic policies when incumbent governments try to increase reelection chances by choosing particular actions. For example, Robinson and Torvik (2005) show that in order to win elections incumbent governments might undertake projects with negative surplus. Since no other politician would undertake such a project, the incumbent can credibly commit to it. Therefore, such a policy guarantees that voters benefiting from the project being undertaken will reelect the incumbent. In Dewatripont and Seabright (2006) political decision makers make effort to signal their diligence. Voters elect a politician who makes more effort, even if ex post it sometimes turns out that projects are loss-making.

Empirical evidence confirms that politicians often decide differently before elections than after elections. In Kalt and Zupan (1984) senators running for reelection to the U.S. Senate voted against their own ideology and in line with the interests of their constituents more often than senators not running for reelection. Persson and Tabellini (2003) show that during years with elections governments of countries with proportional electoral rule expand broad redistributive programs. This is, however, not the case for countries with majoritarian electoral rule. At the aggregate level, common for all countries is a drop in

tax revenues during years with election, but the magnitude of the drop is stronger in countries with majoritarian rules. In all countries government expenditure is lower in the year after the elections. These results suggest that politicians postpone painful expenditure-cutting reforms until after elections, while they make voters happy in the election year with lower taxes and higher public spending. Using a data set of state-owned and private banks in 49 democratic countries, Dinç (2005) demonstrates that state-owned banks in developing countries give more loans in years before elections than in other years. However, for developed countries he finds no statistically significant effect of elections. Neven and Röller (2000) find the election dummy insignificant in the regression explaining variation of total state aid amount to the manufacturing sector in the EU countries in the 1990s.

Evidence therefore suggests that electoral cycles exist in public spending, but are less pronounced in developed countries. I test this finding for EU15, a group of the best developed democracies and economies in the world. I also test if electoral cycles in majoritarian systems are different from cycles in proportional systems.

Legal institutions

Bankruptcy law is an institution likely to have an impact on bailout policy. Some systems might be so effective in discouraging bankruptcy and rescuing firms from bankruptcy that the intervention of the government is not necessary. Other systems might be incapable of saving insolvent firms, providing more scope for government intervention. La Porta and de Silanes (1998) draw attention to an important aspect of bankruptcy law: protection of creditors rights to their claims from insolvent firms. The degree of creditor's rights protection has an impact on their incentives to give credits and on the credit's price. When the degree of protection is high, the price of credit is potentially lower, which might lead to less need for R&R subsidies. Cornelli and Felli (1997) show that extensive creditor rights protection is beneficial for *ex ante* efficiency. Therefore the hypothesis I want to test is whether more creditor's protection reduces the number of bailouts.

Creditors protection in bankruptcy law varies a lot among EU countries. According to the summary by Couwenberg (2001), Sweden has a reorganization procedure, which is very rarely used by firms in trouble because all creditors must receive at least 25% of their nominal claim. In contrast, creditors in France are automatically obliged not to start individual collection proceedings and keep the credit lines open, while management remains in charge of operations. In Germany since 1999 the reorganization procedure gives a lot of scope for bargaining between the creditor and the debtor about the future of the firm in trouble. In all four reorganization procedures in the UK, creditors actively take part in reorganizing debtor's operations.

Government

If politicians are assumed to have preferences over policy outcomes, ideological differences among politicians can drive different bailout decisions. Partisan cycles have been heavily studied in political economics, see e.g. Hibbs (1977); Kalt and Zupan (1984); Alesina (1988); Cusack (1997); Alesina et al. (1997). Cusack (1999) found that fiscal policy of left governments is countercyclical and fiscal policy of right governments is procyclical. This reflects different interests of constituents of the two political views. In this light, bailouts should be done by left governments during recessions and by right governments during booms. However, since a bailout benefits both employees and shareholders, there is no clear prior about which political ideology should bail out more often.

Coalition governments are very common in the European Union. Tsebelis (2002) shows that the number of veto players in the coalition and the ideological distance among them affect policy outcomes the coalition is able to achieve. I will test if the number of governing parties has any impact on the probability of a bailout. On the one hand, more veto players means that it is more likely that one player will oppose a bailout decision, so bailouts in coalitions are less likely. On the other hand, a veto player can force the coalition to agree to a bailout, because he can threaten to quit.

Economics

In order to examine the impact of institutions on bailout policy, economic variables must be controlled for. Otherwise, an omitted-variable problem might show up: if countries with proportional rules have high unemployment and governments bail out to remedy this problem, the real reason for bailouts is lack of jobs and not proportional electoral rule. But if the unemployment variable is not in the model, electoral rule variable will capture the effect.

The four basic economic variables to control for are unemployment rate, current economic performance, wealth and country's size. Each of them may affect bailout decisions: high unemployment rate and poor current economic performance increase the social benefit to a bailout, while wealth and country's size play a role for bailout costs.

4.3 Data

The data set contains information about fifteen member states of the European Union during the years 1992-2003. The starting year is 1992, since it is the first year when a bailout took place which was later investigated by the Commission according to the guidelines issued in 1995. The last year of the time period is the year before the accession of 10 new

member states from Eastern Europe. One observation is a country-year. In years 1992-1994, twelve countries were members of the EU. Austria, Finland, and Sweden joined in 1995 forming the so-called EU15. Table 4.6 reports definitions of all variables and their sources and table 4.8 provides summary statistics for each variable.

As a measure of an example of a targeted fiscal policy, the number of bailouts per country-year is the variable of the main interest for this study. The data is based on Competition Commissioner's decisions about rescue and restructuring aid taken between January 1995 and December 2003 provided by the European Commission.[2] Bailout schemes for small and medium enterprizes were not considered. As dates of bailouts, dates of governments' decisions (intention) to subsidize were considered and not the dates of actual bailouts nor the dates of Commission's approvals, since the gaps between the three can be very large. The dates were retrieved case by case from Commission's documents.

Table 4.1 in the introduction reports bailout numbers in each country. Five EU member states never notified a bailout: all Scandinavian countries, Luxembourg and Ireland. In contrast to that, Germany bailed out 26 times in total.

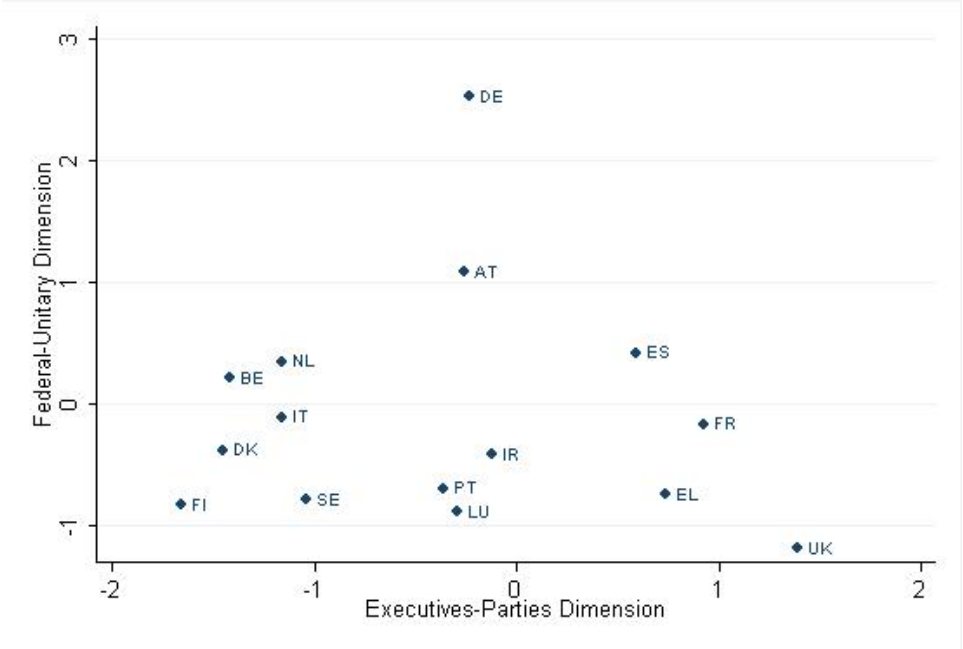
Institutional variables

Two institutional variables crucial in this study are the type of electoral rule and the division of powers between local and central governors. Lijphart (1999) showed that these two dimensions provide a good picture of institutions in a democracy. In the sample of 36 democracies, he derived the executives-parties dimension (index) from five variables: the number of effective parliamentary parties, minimal winning one-party cabinet, executive dominance, electoral disproportionality and interest group pluralism. In the original index, the larger the value of the index, the less majoritarian the democracy and for the ease of interpretation, I multiplied the index by -1. The federal-unitary dimension is derived from federal status by constitution, degree of decentralization, bicameralism, constitutional rigidity, judicial review and central bank independence. The larger the value of the index, the more consensual the democracy. Variables within each dimension are correlated, but there is no correlation between variables from two different dimensions. This observation made Lijphart conclude that the the two indexes are independent.[3] I use the indexes generated by Lijphart for the period 1971-1996. Figure 4.1 shows the location of all EU15 countries along these two dimensions. The figure reveals that by far the most consensual democracy in the EU is Germany, followed then by Austria. The other member states are close together at the unitary side of the dimension. More variation can be

[2]Extensive data set description is available in Głowicka (2006)

[3]Duso (2002) used the same variables in the study of the impact of institutions on regulatory reform of telecommunications industry in OECD countries.

Figure 4.1: Two-dimensional conceptual map of European democracies.



observed in the executives-parties dimension with the UK being the most majoritarian state and Finland the most proportional one.

Dates of elections which determine the head of the government in each country were collected and cross-checked in several internet services (see table 4.6). A year with elections is defined as calendar year during which elections took place. Several out-of-schedule elections took place between 1992 and 2003. All dates are presented in table 4.7 in the appendix.

A variable measuring variation in creditor rights protection in bankruptcy law for 49 countries was created by La Porta and de Silanes (1998). The index is a sum of four dummies, each equal one if investor is protected by law in a particular issue and zero otherwise. The issues are: restrictions for reorganization, no automatic stay on assets, secured creditors are paid first and management does not stay during reorganization. The more issues guaranteed by law, the more secure creditors are. Table 4.2 presents the scores among EU15 countries.

Political variables

The data about governments' political characteristics comes from Parties - Governments - Legislatures Data Set (PGL) (Cusack and Fuchs, 2002; Cusack and Engelhardt, 2002). The data set contains very rich information about ideology, party composition and support in the lower house for each government. The observation for Ireland in 2003 is missing.

Ideological position of governments in the left-right dimension is coded as -1 for left-,

Table 4.2: The UK and France represent two extremes in creditor rights protection.

Creditor rights index	Country
4	UK
3	Denmark, Germany
2	Austria, Netherlands, Belgium, Italy, Spain, Sweden, Finland Luxembourg
1	Greece, Ireland, Portugal
0	France

0 for center- and 1 for right-wing governments. Percentage of seats in lower house held by the government is a number between 0 and 100. The number of parties in the cabinet indicates whether the government is a coalition or not (I also use a dummy for a coalition government). Government's share of votes against the opposition in the lower house is coded as an ordinal variable equal 1 if government has a minority, 2 if equal and 3 if majority share of votes. Finally, government's vote share in the last elections is coded as a number between 0 and 100.

Economic variables and controls

Economic variables come from IFS. Unemployment and real GDP growth are measured in percentage points. To control for the size of the country, logarithm of the size of population is used. Logarithm of GDP per capita proxies wealth of the country.

4.4 Methodology

Panel data allow me to use both cross-country and time-series variation in the estimation. Let i be a country index and t a year index. The following equation will be estimated:

$$Y_{it} = \alpha' X_{it} + \beta' Z_{it} + \gamma_i + \theta_t + u_{it} \tag{4.1}$$

where Y_{it} is a dummy variable equal one if there was at least one bailout in country i in year t and zero otherwise, X_{it} is a vector of exogenous institutional and political variables, Z_{it} is a vector of exogenous economic controls, γ_i is a country fixed-effect, θ_t is a year fixed-effect and u_{it} is the error term. Country fixed-effect γ_i captures unobserved time-invariant country characteristics, e.g. strength of unions, culture, etc. Time fixed-effect θ_t accounts for unobserved heterogeneity in the time dimension, e.g. EU-wide events like introduction of the common currency EUR, appointment of the new Commission, terrorist attacks in 2001, etc. Institutional and political variables will be tested separately

due to potential endogeneity between the two groups. Since most of institutional variables are time-invariant, regressions with institutional variables do not include country fixed-effects. In that case, if the institutional variables are correlated with some unobserved country characteristics captured by the error term, the estimates might be biased. Still, including country fixed-effects to the regression means that all variables constant in time need to be dropped. The results of such regression are included as a robustness check in section 4.5.1. Country-fixed effects are however included in all regressions with political variables since political variables change over time.

Estimation procedure is a maximum-likelihood probit regression with standard errors clustered at the country level to avoid bias due to country-level autocorrelation. The equation is estimated based on ten countries with at least one bailout. Then the estimates are used to predict bail-out policy in the remaining five countries. The results of each regression include a specification test (link test), goodness of fit test, area under ROC curve and the number of correctly predicted outcomes.

4.5 Results

4.5.1 Institutions and Elections

Table 4.3 reports results of the regressions testing the hypotheses about institutional determinants of bailouts. The difference between the two models is how elections are treated: in the first model there is one dummy variable for election years, so that all countries are assumed to have the same impact of elections on bailout decisions. In the second model there is an election year dummy for each electoral rule: separately for countries with majoritarian, proportional and mixed systems. Both regressions pass the link specification test. However, the second regression outperforms the first one in all other diagnostic tests. Prediction of both bailout and no-bailout events improves, goodness-of-fit test is now passed and the sensitivity-specificity trade-off is better resolved (area under ROC is larger).

The results regarding institutions are consistent with the theory presented in section 4.2. First, the more majoritarian country's constitution, the more likely bailouts in that country in all years. The effect is large in magnitude and statistically significant in both regressions, even though it gets weaker in model 2. Second, the more federal the country, the more likely bailouts in that country in all years. This effect is large in magnitude and significant in both model specifications. Creditor's rights in bankruptcy protection turn out to be irrelevant.

The estimates for the set of six dummies in the second model specification provide

Table 4.3: Probit regressions: institutions and elections as determinants of bailouts.

	Model 1		Model 2	
Variable	Par. estimate	St. error	Par. estimate	St. error
Executives-Parties Dimension	0.481***	0.125	0.286*	0.159
Federal-Unitary Dimension	0.716***	0.128	0.831***	0.112
Creditor rights	0.139	0.245	0.178	0.237
Year of elections	-0.330	0.419		
Year before elections	0.162	0.348		
MAJ year of elections			1.109	0.904
MAJ year before elections			1.129**	0.454
MIXED year of elections			-0.281	0.397
MIXED year before elections			-0.216	0.542
PROP year of elections			-0.990	0.624
PROP year before elections			-0.025	0.437
Unemployment rate	-0.006	0.068	-0.021	0.068
Real GDP growth	0.116	0.105	0.078	0.101
log Population	-0.241	0.150	-0.237*	0.127
log GDP per capita	0.055	0.628	-0.748	0.855
year 1992	0.128	0.931	-0.133	0.893
year 1993	1.348*	0.696	1.303*	0.763
year 1994	0.642	1.079	0.706	1.061
year 1995	1.496*	0.790	1.754**	0.870
year 1996	1.924***	0.662	1.877***	0.635
year 1997	1.734**	0.681	1.494**	0.672
year 1998	2.120***	0.772	2.312***	0.745
year 1999	1.230*	0.730	1.578**	0.745
year 2000	0.337	0.547	0.614	0.515
year 2001	1.589***	0.582	1.443***	0.544
year 2002	1.706***	0.580	1.851***	0.670
Constant	1.229	5.696	9.126	7.984
N/correctly predicted	117/90		117/97	
Nonzero N/ corr pred	48/33		48/37	
Pseudo R2	0.3135		0.3512	
Area under ROC curve	0.8424		0.8744	
Goodness-of-fit test, p-value	0.1242		0.0003	

Standard errors clustered at country level in parentheses. ***(**,*) denotes significance with 1% (5%, 10%) level in a two-tailed Wald test.

evidence that electoral cycles in bailout policy exist. In majoritarian systems in years just before election years bailouts are more likely than in other years. In contrast to that, in proportional systems bailouts are less likely to take place in years with elections (11.3% significance).

Out of economic controls the estimate of the coefficient for GDP growth rate is almost

significant with a positive sign. Such a result suggests that *ceteris paribus* countries during booms bail out more frequently than countries in recession. In contrast, unemployment and population estimates are insignificant. The results therefore do not provide strong evidence of the impact of slowdowns in economic cycle on bailout decisions.

The estimates of the parameters for year dummies are interesting on their own, since they reflect the reaction of bailout policies to unobserved common events. In both specifications the estimates follow the same pattern: they increase until the year 1998 dummy with the highest estimate, then they drop to a very low estimate for the 2000 dummy and they pick up subsequently. Which events could be responsible for this pattern? The drop in 1999 and 2000 might be a result of the appointment of the new Commission with the Competition Commissioner Mario Monti, who started a reform of state aid policy. In 1999 the new rescue and restructuring guidelines were introduced, which were supposed to limit the number of bailouts in the EU. The increase in 2001 is likely to be a result of terrorist attacks which were followed by a few bailouts of airlines.

Since the regressions are based only on data from countries with at least one bailout, I can use data from countries without bailouts to test the accuracy of the models' out-of-sample prediction. Model 1 predicts one year with bailout in Denmark with more than 50% chance and five other years with bailouts in Denmark, Luxembourg and Ireland with more than 30% chance. In model 2, bailout probability never exceeds 30% in all country-years without bailouts from the data set. This suggests that the model with election cycles for each of the electoral systems separately is able to capture differences in bailout policies very well.

Robustness

The main concern about the results in the previous subsection is self-selection. It is possible that not the institutional differences but unobserved heterogeneity among countries drives the results. To check if this concern is sound, equation 4.1 is estimated with country fixed effects. For this to be possible, three variables constant in time have to be dropped: Executives-Parties and Federal-Unitary indexes and creditor rights index, but the coefficients of variables representing electoral cycles for each electoral rule and economic controls can be estimated. The results are presented in table 4.4 and largely confirm earlier findings with the significant and positive estimate of the coefficient for the pre-election year dummy in majoritarian countries.

Table 4.4: Probit regression with both year and country fixed-effects.

Variable	Par. estimate	St. error	t	p-value
MAJ year of elections	.822	.873	0.94	0.346
MAJ year before elections	.859	.395	2.17	0.030
MIXED year of elections	-1.520	.683	-2.23	0.026
MIXED year before elections	-1.480	1.094	-1.35	0.176
PROP year of elections	-.786	.649	-1.21	0.226
PROP year before elections	.130	.407	0.32	0.749
Unemployment rate	-.080	.090	-0.89	0.374
Real GDP growth	-.042	.153	-0.27	0.784
log Population	-21.134	12.311	-1.72	0.086
log GDP per capita	-8.461	8.219	-1.03	0.303
Constant	446.957	277.204	1.61	0.107

Year and country fixed-effects included, not reported. Number of observations: 117. Pseudo R2= 0.4246

4.5.2 Government

Table 4.5 reports estimates of government characteristics as bailout policy determinants. The data set is reduced to 116 observations due to a missing observation for Ireland in 2003. Each regression includes year and country fixed-effects and a constant (2003 and Portugal are left out). Model 1 contains all political and economic variables I consider. To test the prediction of Cusack (1999) that governments with different ideologies choose fiscal policy differently depending on the business cycle, specifications with an interaction term of ideology with unemployment (model 2) and coalition with unemployment (model 3) were also estimated. Each model passed a link specification test.

Two variables characterizing government's political strength turn out statistically significant. Percentage of seats in lower legislative house held by the government comes out consistently with a positive and significant coefficient, while the coefficient of the coalition dummy is significant and negative in the first two models.[4] These results suggest that *ceteris paribus* politically strong governments are more likely to make bailout decisions: one-party governments bail out more often than coalitions and the larger government's support in the legislature, the more likely bailouts are.

The estimates of coefficients for ideology and ideology interacted with unemployment are insignificant. Hence, on average, ideological position of governments is irrelevant for bailout policy irrespective of the business cycle.

Economic factors with the strongest impact on bailout policy are country's wealth and size. *Ceteris paribus*, smaller or poorer countries are more likely to bailout. Since

[4]Correlation coefficient between the two variables is only .31.

Table 4.5: Probit regressions: government characteristics as determinants of bailouts.

Variable	Model 1	Model 2	Model 3
Gov. seats	0.115***	0.115***	0.137**
	(0.039)	(0.038)	(0.056)
Gov. vote share	-0.077	-0.074	-0.101
	(0.051)	(0.053)	(0.069)
Ideology	0.209	0.731	0.204
	(0.340)	(0.947)	(0.351)
Coalition	-2.328**	-2.248*	-0.440
	(1.087)	(1.184)	(2.822)
Ideology*Unemployment		-0.052	
		(0.095)	
Coalition*Unemployment			-0.154
			(0.210)
Unemployment rate	-0.191	-0.211*	-0.133
	(0.146)	(0.128)	(0.163)
Real GDP growth	0.107	0.125	0.121
	(0.153)	(0.155)	(0.152)
ln Population	-18.080	-18.698*	-19.731*
	(10.992)	(11.233)	(11.837)
ln GDP per capita	-13.379*	-13.692*	-12.818
	(7.896)	(8.047)	(7.833)
N/correctly predicted	116/97	116/94	116/100
Pseudo R2	0.4339	0.4358	0.4376

Standard errors clustered at country level in parentheses. Year and country fixed-effects included, not reported. ***(**,*) denotes significance with 1% (5%, 10%) level in a two-tailed Wald test.

descriptive statistics in table 4.1 suggest rather the opposite, this finding shows the importance of econometric analysis. When controlling for other variables, it turns out that big or rich countries bailout frequently for reasons other than their size or wealth. Estimate of unemployment's coefficient is significant in model specification 2, with a negative sign suggesting that the lower unemployment rate, the more likely bailouts. Since this model specification includes also an interaction term of unemployment and ideology, the more precise interpretation of this coefficient is that the negative relationship is statistically significant when the interaction term nullifies, i.e. for central governments (ideology$= 0$).

4.6 Conclusions

In the influential book "The Economics of Shortage", which coined the term *soft-budget constraints* in economics, Janos Kornai wrote that *there is a close relationship between the set of economic phenomena (...) and the set of institutional phenomena (...): the latter largely explains the former one.*[5] Institutional settings in which politicians make decisions create incentives both for politicians and for citizens affected by the decisions and in this way they influence economic outcomes (Börner, 2005). According to the results in this paper, electoral rules and the division of power between central and local institutions (consensus dimension) significantly affect bailout policy: governments in majoritarian or federal countries bail out more often. Another finding is that politically strong governments are more likely to bailout.

What lesson can be drawn from this evidence? Since electoral and institutional motivations of politicians matter for bailout policies, inefficient bailouts are likely to be very common. In the European Union, the use sound economic analysis in the state aid control process could help to reduce their number.

4.7 Appendix

Table 4.6: Data set: variables, definitions and sources.

Variable	Definition and Source
Number of bailouts	Number of bailouts in a given year, in a given country. Source: DG Competition, European Commission
Institutional variables	
Executives-parties dimension	An index for a given country reflecting how majoritarian its democracy is Source: Lijphart (1999)
Federal-unitary dimension	An index for a given country reflecting how consensual its democracy is Source: Lijphart (1999)
Years with elections	Dummy equal one if in a given year, in a given country elections that determine the head of the government took place.

[5] Kornai (1980), p.569.

Table 4.6 – continued

Variable	Definition and Source
	Source: International Institute for Democracy and Electoral Assistance (IDEA), Elections around the World (www.electionworld.org) and Election Resources on the Internet (www.electionresources.org)
Creditor rights	0-weak, 4 strong creditor rights Source: La Porta and de Silanes (1998)
Political variables	
Ideology	Based on The Center of Political Gravity of the Cabinet index, expressing ideological position of the government. -1 for left-, 0 for center- and 1 for right-wing parties. Source: PGL data set, Cusack and Fuchs (2002)
Government seats	Percentage of seats in lower house held by the government Source: PGL data set, Cusack and Fuchs (2002)
Government's vote share	Percent of votes in elections for the governing parties. Source: PGL data set, Cusack and Fuchs (2002)
No of gov. parties	Number of parties in the cabinet. Source: PGL data set, Cusack and Fuchs (2002)
Economic variables	
Population	Number of citizens Source: Economic Research Service, US Dept. of Agriculture
Real GDP growth	Real GDP growth rate in %. Source:IFS
Unemployment rate	Unemployment rate in %. Source:IFS
GDP per capita	GDP per person in EUR. Source: IFS

Table 4.7: Dates of legislature elections in the EU15 between 1992 and 2003.

Country	**Dates of elections**
Austria	09.10.1994, 17.12.1995, 03.10.1999, 24.11.2002
Belgium	21.05.1995,13.06.1999,18.05.2003
Denmark	21.09.1994,11.03.1998,20.11.2001
Finland	19.03.1995, 21.03.1999, 16.03.2003
France	21.03.1993, 25.05.1997, 09.06.2002
Germany	16.10.1994, 27.09.1998,22.09.2002
Greece	10.10.1993, 22.09.1996, 09.04.2000
Ireland	25.11.1992, 06.06.1997, 17.05.2002
Italy	06.04.1992, 28.05.1994, 21.04.1996, 13.05.2001
Luxembourg	12.06.1994, 13.06.1999
Netherlands	03.05.1994, 06.05.1998, 15.05.2002, 22.06.2003
Portugal	01.10.1995, 10.10.1999, 17.03.2002
Spain	06.06.1993, 03.05.1996, 12.03.2000
Sweden	18.09.1994, 21.09.1998, 15.09.2002
United Kingdom	09.04.1992, 01.05.1997, 07.06.2001

Table 4.8: Summary statistics for all variables.

Variable	**N**	**Mean**	**St.Dev.**	**Min**	**Max**
Year with bailout	171	.2807018	.4506617	0	1
Executives-Parties Dimension	171	-.3340351	.9250396	-1.66	1.39
Federal-Unitary Dimension	171	-.105614	.9229238	-1.19	2.53
Creditor Rights	171	1.929825	1.009245	0	4
Ideology	168	-.0297619	.712805	-1	1
Coalition	169	.6686391	.4721013	0	1
Gov. seats	169	55.22672	10.39441	0	81.80243
Gov. vote share	169	48.37399	10.0231	0	69.31438
Real GDP growth	171	2.821877	2.320378	-3.327971	11.57062
Population	171	2.50e+07	2.59e+07	392552	8.24e+07
GDP per capita	171	20874.21	7461.151	8399.4	45962.89
Unemployment rate	171	9.189134	4.426782	1.6	23.662

The statistics cover all observations, including no-bailout countries not used in the regressions.

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Selbständigkeitserklärung

Hiermit erkläre ich, dass die vorliegende Dissertation von mir selbstständig und nur unter Verwendung der angegebenen Hilfsmittel angefertigt wurde.

Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entschprechen.

Berlin, den 24.03.2008 Elżbieta Głowicka