EQUITY INVESTMENTS WITH PRIVATE BENEFITS OF CONTROL

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ABSTRACT

This dissertation analyzes the effect of control benefits on equity investment decisions. It first develops an extension of the classic dividend discount models that differentiates the value of cash flows to the firm and the distribution of these cash flows among shareholders. The single stock valuation model is incorporated into the optimal equity portfolio problem of a large investor. The solution counterweighs the benefits of higher returns through private benefits of control and monitoring efforts when an investor purchases a large equity block with the costs of bearing diversifiable risk. The model predicts that budget-constrained investors will be more likely to buy controlling blocks in smaller firms, and in firms where higher private benefits of control can be secured. The dissertation afterwards presents empirical evidence regarding the predictions of the developed equity valuation and portfolio optimization theory. Using a unique data set containing the valuation of large investors for equity blocks, the existence of private benefits of control for different sized blocks is documented. Further exploration of the determinants of portfolio choices reveals that institutions prefer to obtain large blocks in smaller firms, and in firms located in their geographical proximity. Investors with more capital are more likely to bid for large blocks and to form bidding coalitions. The results are strongly consistent with the hypotheses advanced in the theoretical part of the dissertation.
# TABLE OF CONTENTS

LIST OF FIGURES ......................................................................................................... vii

LIST OF TABLES ........................................................................................................ viii

ACKNOWLEDGMENTS ............................................................................................ x

Chapter 1 INTRODUCTION ...................................................................................... 1

Chapter 2 EQUITY VALUATION WITH BENEFITS OF CONTROL ...................... 6

   2.1 Theoretical studies of corporate control .......................................................... 7
   2.2 Empirical studies of corporate control ............................................................ 11

Chapter 3 OPTIMAL PORTFOLIO INVESTMENTS WITH BENEFITS OF
CONTROL ........................................................................................................... 16

   3.1 The model ....................................................................................................... 17
      3.1.1 Assumptions ............................................................................................. 18
      3.1.2 Specification of the program and solution for $\theta_i$ and $m_i$............... 24
      3.1.3 Effects on the value of shares of small shareholders from the existence of a large investor ................................................................. 27
      3.1.4 Final formulation of $L$’s optimization problem .................................... 30
   3.2 A special case of the model ............................................................................ 31
      3.2.1 Model description and theoretical results ............................................. 31
      3.2.2 Numerical results .................................................................................. 36
         3.2.2.1 Determinants of the probability of a majority block in a particular firm to be included in L’s portfolio ......................................... 37
         3.2.2.2 Portfolio expected return and variance ........................................... 37
         3.2.2.3 Expected utility for different economies and budget constraints ....................................................................................... 38
   3.3 Empirical predictions ...................................................................................... 39

Chapter 4 INSTITUTIONAL FRAMEWORK AND DATA ...................................... 49

   4.1 Institutional framework ................................................................................... 49
4.1.1 The mass privatization auctions ...........................................................49
4.1.2 The privatization funds .......................................................................50
4.1.3 Bidding coalitions and trading agreements ..........................................52
4.2 Data .........................................................................................................53
  4.2.1 Sample selection ................................................................................53
  4.2.2 Bids by privatization funds ...............................................................57
  4.2.3 Bids by Individual investors ...............................................................59

Chapter 5 HYPOTHESES, EMPIRICAL PREDICTIONS, AND UNIVARIATE
STATISTICS ................................................................. 74
  5.1 Testable predictions of the hypotheses ....................................................74
    5.1.1 Hypothesis 1 ...................................................................................74
    5.1.2 Hypothesis 2a ................................................................................76
    5.1.3 Hypothesis 2b ................................................................................77
    5.1.4 Hypothesis 2c ................................................................................77
  5.2 Univariate tests of the hypotheses ..........................................................78

Chapter 6 ECONOMETRIC MODEL AND RESULTS .............................................85
  6.1 Econometric model ...............................................................................85
  6.2 Model estimation .................................................................................87
    6.2.1 First-stage selection equation .........................................................87
    6.2.2 Second-stage regressions .................................................................88
  6.3 Results ..................................................................................................90
    6.3.1 Results about the investment choice hypotheses ...........................90
    6.3.2 An estimate of the private benefits of control .................................92
  6.4 Results from an extended model ............................................................93

Chapter 7 EXTENSIONS ..................................................................................104
  7.1 Extensions to the theoretical model ......................................................104
    7.1.1 Extensions to the single large investor model ..................................104
    7.1.2 Multiple Strategic Investors ............................................................106
  7.2 Development of new tools for strategic investing and extensions to the
  empirical tests ..............................................................................................109
    7.2.1 Tools for strategic investing ............................................................110
      7.2.1.1 Coalition formation .................................................................110
      7.2.1.2 Power indexes and strategic investing .......................................111
      7.2.1.3 Ownership and control structures .........................................112
    7.2.2 Additional empirical tests ...............................................................113
      7.2.2.1 Coalition formation during the Bulgarian mass privatization
        auctions ...........................................................................................113
      7.2.2.2 Portfolio selection of large investors ........................................113
      7.2.2.3 Firm ownership structures .......................................................115
LIST OF FIGURES

Figure A–1: A pseudo capital allocation line traced by a large investor with capital equal to 1 ..........................................................47

Figure A–2: Portfolio returns and variance for investors with different total capital..48

Figure B–1: Distribution of the number of single bids by percentage of equity (bidpct2) ..................................................................................................................64

Figure B–2: Distribution of the number of coalitional bids by percentage of equity (bidpct2) ..................................................................................................................65

Figure B–3: Distribution of the number of coalitional bids by the sum of percentage of equity (coalpct2) .................................................................66
**LIST OF TABLES**

Table 3–1: Notation ........................................................................................................44

Table 3–2: Determinants of the decision to buy majority blocks ...............................45

Table 3–3: Average certainty equivalents of holding a portfolio in different scenarios ..........................................................................................................................46

Table 4–1: Names and descriptions of all variables ..................................................67

Table 4–2: Distribution of all firms available on the second auction round across different types .................................................................................................................68

Table 4–3: A multinomial model of the probability of a firm to receive bids of particular type ..................................................................................................................69

Table 4–4: A Poisson model of determinants of the number of bids of particular type that a firm receives..........................................................................................70

Table 4–5: Comparison of in-sample firms with the rest of the firms that received at least one bid ................................................................................................................71

Table 4–6: Determinants of demand by individual investors ......................................72

Table 4–7: A comparison of actual win allocations and null allocations of different bid types ......................................................................................................................73

Table 5–1: Summary statistics of different sized bids .................................................82

Table 5–2: Summary statistics of bid prices for different types of firms ....................83

Table 5–3: Prices of two-fund coalitional bids ............................................................84

Table 6–1: First-stage multinomial logit estimation results ........................................97

Table 6–2: Second-stage regression results ................................................................99
Table 6–3: Conditional expected bid prices ................................................................. 100

Table 6–4: First-stage multinomial logit estimation results. Extended Model .......... 101

Table 6–5: Conditional expected bid prices. Extended model ............................... 103

Table D–1: Distribution of the number of funds that decide to bid for a certain firm ........................................................................................................................................ 153

Table D–2: Distribution of the number of firms that a fund bid for ....................... 154
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Chapter 1
INTRODUCTION

Equity entitles its owner to the right to receive a stake in all future cash flows of a company or its liquidation value, and the right to vote. If an investor is sufficiently large, she can utilize her right to vote in two ways. First, compared to small shareholders, a large shareholder has both higher incentives and better opportunities to monitor management and improve firm performance. The activities of the large shareholder lower agency costs in the firm and increase the cash flows for all shareholders.

Second, a controlling shareholder or a coalition can attain direct monetary or other private benefits of control at the expense of the cash flows of smaller shareholders. In the extreme case when the legal environment does not offer any protection of the ownership rights of small shareholders, the owner of a majority interest in a company can expropriate fully all assets and cash flows of the company. In such settings, the ownership of sufficient control rights becomes a strong necessary condition to receive any cash flows after investing in equity.

The majority of existing equity valuation and investment models assume away the existence of control rights. To the best of my knowledge there are only a few examples of studies that model a portfolio investment problem with corporate governance features: Amihud and Barnea (1974), Gambarelli (1982), and Admati, Pfleiderer and Zechner (1994). These studies either ignore private benefits of control or do not provide a formal solution to the equity valuation and portfolio problem. The central goal of the theoretical
part of the dissertation is to fill this gap in the literature and explore the asset pricing and portfolio investment implications of the existence of valuable control benefits.

The theoretical model in the dissertation focuses on two additional factors that are abstracted from in existing studies determine optimal portfolio allocations – the budget constraints of investors and the market value of firms. Buying large (in terms of percent of total equity) blocks in smaller firms requires less capital than buying large blocks in larger firms. As a result, in a world where private benefits of control exist, investors will tend to have more concentrated portfolios and hold large blocks in smaller firms. The mean-variance efficient frontier is different for each investor and depends on the available capital that each investor controls. In general, large investors earn higher risk-adjusted returns.

Isolating the value of voting rights from equity prices and especially determining the size of the private benefits of control has been a major question in corporate governance research. The main goal of the empirical part of the dissertation is to test the predictions of the theoretical model developed here and to provide a measure of the value of private benefits of control associated with large blocks of equity. The dissertation employs a unique data set of differently priced bids submitted by institutional investors (the Bulgarian privatization funds) for shares of a large number of firms privatized in the Bulgarian mass privatization auctions. The empirical methodology applied below and the unique dataset allow for a thorough empirical analysis of the value of control.
In accordance with the main goals of the empirical part of the dissertation, the following hypotheses are tested:

(1) **Substantial benefits of control exist and they determine equity valuation**

(2a) **Investors will be more likely to buy large blocks in smaller firms**

(2b) **Investors with larger capital will be more likely to buy large blocks**

(2c) **Investors located in the geographic proximity of a firm will be more likely to invest in this firm**

Hypothesis 1, 2a, and 2b are derived directly from the theoretical model. Hypothesis 2c is proposed as an attempt to address the prediction that investors will prefer firms with higher benefits of control and lower risk. The preference of investors towards firms located in their geographic vicinity has been documented in Coval and Moskowitz (1999). There, the authors motivate the existence of this preference with asymmetric information. Although not discussed in Coval and Moskowitz (1999) or the rest of the literature on home bias, monitoring or control issues may also contribute to the reasons why investor are more likely to include local firms in their portfolios. Controlling shareholders that are located close to a firm may be able to monitor managers better, because the shareholders can more precisely ascertain managerial performance or can closely oversee firm operations¹. Majority owners may also find more opportunities to extract private benefits of control from geographically adjacent firms. If firm unique risk and expected control benefits are important factors to consider when making investment

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¹ Evidence consistent with the strong influence of geographical proximity on the efficiency of monitoring can be found in the venture capitalist research. See for example Lerner (1995) or Gompers and Lerner (1999).
decisions, and geographical proximity can reduce uncertainty and increase control benefits, then investors will be more likely to bid for firms located in their region.

In order to explore the predictions of the hypotheses outlined above, I estimate a polychotomous selection model developed by Lee (1983). The main finding is that blocks with ex-ante higher expected voting power are valued at higher prices. The value of shares in controlling blocks is estimated to be as high as ten times the value of shares in small blocks. This evidence supports the first hypothesis that private benefits of control exist and are the dominant factor of investors’ valuations when investor protection is weak and respectively the cash flow rights of minority investors are of negligible value. The estimated premium for control is much larger than the documented premium in the USA and other developed markets. This finding is consistent with the conjecture that the size of private benefits of control is inversely related to the level of minority investor protection. The results offer strong support for the portfolio selection hypotheses. Smaller firms are very attractive targets for large investors. Institutions with more capital are more likely to submit large bids. Investors submit significantly more bids for firms in the same region.

The remainder of the dissertation is structured as follows. In Chapter 2, I outline an extension of the classic dividend discount equity valuation models that incorporates the value of control into equity prices. In Chapter 3, the equity valuation model is integrated into the portfolio decision making of a large investor. Chapter 4 includes relevant institutional details concerning the creation of the Bulgarian capital market.
through mass privatization auctions and subsequent trading on the Bulgarian Stock Exchange, and describes the data. Chapter 5 develops testable hypotheses based on the theoretical model in Chapter 3 and presents univariate tests of these hypotheses. The results from multivariate econometric analysis of the hypotheses are summarized in Chapter 6. Chapter 7 proposes several theoretical, methodological, and empirical extensions. Chapter 8 concludes.

\[\text{See La Porta et al. (2000), Dyck and Zingales (2001), and Nenova (2001) and the papers cited within for other studies that document this relationship.}\]
Chapter 2

EQUITY VALUATION WITH BENEFITS OF CONTROL

The discussion in the introduction about the effect of control on equity valuation can be illustrated by the following general equation for the value at $t = 0$ of a share in an equity block of size $\alpha_i$ percent of firm equity.

$$VALUE_{0,i} = \left( \sum_{t=1}^{\infty} \frac{PV(CF_t)}{\# Shares} \right) \kappa(\alpha_i, \alpha_{-i}, \theta)$$  \hspace{1cm} (2.1)

where $\kappa$ is a control function that measures the bargaining power associated with the block $\alpha_i$, $\alpha_{-i}$ is the vector of ownership stakes of all other shareholders, and $\theta$ is a measure of shareholder protection. The equation is based on the classic dividend discount models, but adds an additional multiplicative factor $\kappa$ that reflects the fact that cash flows to the corporation may not be transferred without frictions to all shareholders. In many publicly traded companies in the USA or UK, the value of $\kappa$ may be close to one. Ignoring this term in equity valuation may be not too costly. As shareholder protection decreases, the dynamics of $\kappa$ becomes a much more important factor in equity valuation than the value of future cash flows to the firm. In emerging markets, Continental Europe or East Asia, for blocks of small size $\kappa$ is close to zero, while for large $\alpha_i$ and dispersed $\alpha_{-i}$, $\kappa$ may be much greater than one.
Below I review the existing literature on bargaining and corporate governance, and propose ways to formalize $\kappa$. The chapter also surveys the existing evidence in the corporate governance literature about the size of the private benefits of control and the determinants of the control premium. The survey motivates the creation of an extended model of investor decision making that will solve the inherent selection bias problem in the existing empirical studies of the control premium.

2.1 Theoretical studies of corporate control

There are two approaches of measuring control or power in the theoretical economic, political science, and law literature$^3$. The first approach is to view control as the ability to influence the decisions of a voting body. The power to influence is measured by the probability to be pivotal in a voting contest and is formalized by the Banzhaf index (Banzhaf (1965)). The second approach to measure power is to compute the expected share of a player in bargaining over the distribution of a prize. This notion of power is mathematically measured by the Shapley-Shubik index (Shapley and Shubik (1954)). Both the Banzhaf and Shapley-Shubik index assign to each player a number between 0 and 1 based on her voting rights. A power index of 1 means absolute power, a power index of 0 means no power.

One result from the theoretical work on measures of control is that the value of control associated with a block of equity depends on the size of the block and the whole ownership structure of the company. As the size of an equity block increases, its voting
rights may become disproportionately more valuable, because the owner of the block gains the potential to participate in controlling coalitions or even to become a majority shareholder and unilaterally govern the company\textsuperscript{4}. For example, in a company where all corporate decisions are made with a simple majority rule, regardless of the ownership of other shareholders, a holder of a 50\% block has full control both in terms of influencing the decisions of the board of directors and the distribution of cash flows. Conversely, the holder of a 1\% block has negligible power in most firm ownership structures. The owner of such block has maximum power in a company with two shareholders that each has close to but less than 50\% of the shares.

We can easily implement the theoretical work on power indices in the formulation of the control function $\kappa$. In the simple case where there are no legal restrictions on the distribution of cash flows to shareholders, the value of $\kappa$ for an equity block will be the power-per-share ratio of this block. The power per share ratio is the value of a chosen power index (Banzhaf or Shapley-Shubik) divided by the size of the block measured as percentage of firm capital.

In most economies, the law protects the cash flow rights of minority shareholders. In such markets, it is difficult for a controlling shareholder to expropriate all assets and cash flows of a firm. The legal protection thus increases the bargaining power of small shareholders and compensates for their lack of substantial voting rights. This is not the case in many emerging and transitional economies. The underdeveloped legal system, the

\textsuperscript{3} For more information on measuring power see Felsenthal and Machover (1998).
\textsuperscript{4} See Section 7 for further discussion of coalitions between shareholders and their effect on equity valuation.
corruption in courts, or the widespread tax evasion leaves many opportunities for a controlling shareholder to enjoy fully the benefits of his power. The theoretical measures of power provided by the Banzhaf and Shapley-Shubik index have to be extended with the notion that power is limited by law, and that different countries have different legal protection of small shareholders. One place to find such extension is in the theoretical corporate governance literature.

Originally, the corporate governance literature assumed in an ad hoc manner that the value of control that accrues to majority shareholders is an additive constant on top of their dividend rights. Demsetz and Lehn (1985) motivate this additive control benefits as, for example, the non-pecuniary perks from high social status that are enjoyed by the owners of sports clubs in the USA. The major idea involved in this simple functional form for the benefits of control is that minority shareholders enjoy enough legal protection so that they can receive equal treatment with controlling shareholders in the distribution of firm cash flows. Later, the theoretical research on corporate control develop the notion that a controlling shareholder can expropriate small shareholders and that the private benefits of control arise in a zero-sum game that involves unequal distribution of firm cash flows. Burkart, Gromb, and Panunzi (1998) formalize this form of private benefits of control with a “transfer function” that measures how costly it is to transfer cash from the firm to the large shareholder. The legal protection in a market and the ownership stake of the large shareholder determine the optimal level of expropriation,

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5 One study that describes real-life examples of how controlling shareholders may benefit from their control at the expense of the remaining owners is Johnson, La Porta, Lopez-de-Silanes, and Shleifer (2000)
where at the extreme case of ideal legal protection the large shareholder does not secure any private benefits of control and the classic dividend discount model values equity perfectly. This approach to model the value of corporate control is implemented by other studies like Shleifer and Wolfenzon (2000) and has been established as an appropriate mathematical methodology. This motivates its use in the theoretical model in Chapter 3.

Besides outside legal protection, the theoretical studies of power make an additional strong assumption that the value of the prize to be distributed is independent of the players’ actions. The theoretical corporate governance literature has also developed ways to model the possibility that a large shareholder may not only expropriate some cash flows from the firm \textit{ex post}, but may also increase all firm cash flows through actively monitoring managers \textit{ex ante}.

The seminal study of Jensen and Meckling (1976) introduced the agency problem between professional managers that govern a corporation and its shareholders that hold residual ownership rights. If managers do not own 100\% of the corporation, they have incentives to make suboptimal decisions that decrease shareholder value but increase managerial utility. As Jensen and Meckling point out, one of the ways to reduce the dead loss from agency costs is if shareholders actively monitor managers. After this study, a large literature has developed that analyzes the incentives for shareholder to monitor managers and increase firm value. Notable theoretical studies include Shleifer and Vishny (1986), Grossman and Hart (1988), Harris and Raviv (1988), Admati, Pfleiderer, and Zechner (1994, from here on APZ), and a recent survey by Shleifer and Vishny (1997). The results from the theoretical models are that a shareholder has to have a
substantial stake in a company in order to find it feasible to spend money and effort on monitoring managers. The existence of a large shareholder increases firm value and has a beneficial effect on the remaining small shareholders who free ride on the large shareholder’s efforts. The key point in this literature, relevant for the analysis of \( \kappa \), is that the distribution of firm cash flows may not be a zero-sum game. Certain ownership structures may increase the value of total firm cash flows that are to be distributed among shareholders.

Any theoretical model of equity valuation that incorporates corporate control has to account for the monitoring benefits of a large shareholder. Also, private benefits of control cannot be modeled independently from monitoring because a large shareholder may monitor firm managers more if she expects to secure a larger part of the gains from monitoring. A convenient mathematical model of the monitoring technology is developed by APZ. There, the authors formalize monitoring by a monitoring cost function and establish the required assumptions for it to be well behaved mathematically. The theoretical model in Chapter 3 will utilize this function in the equity valuation and optimal portfolio mode and will incorporate both effects of a large shareholder on equity valuation.

### 2.2 Empirical studies of corporate control

After reviewing the existing theoretical literature on corporate control, the next natural step is to summarize the findings of empirical studies on the value of control. The control premium embedded in the price of each share is not independent of the identity of
the investor holding the share and the distribution of equity among other investors. This fact makes impossible to measure control benefits using market prices. In order to isolate the value of control, the researcher needs to observe at least two prices for shares in the same company, but which have differential voting power.

Extant empirical evidence about the premium for control is offered by two broad sets of studies that utilize the existence of more than one price for shares in the same company. The first group of studies examines the price differential between the share classes of dual-class firms. Dual-class shares firms offer an opportunity to researchers to isolate the value of control by comparing the prices for shares that have similar dividend rights but different voting rights. Some examples include Lease, McConnell, and Mikkelson (1983), Zingales (1994), and a recent survey and cross-country study of dual-class share firms by Nenova (2001). Based on results in Nenova (2001), the value of control measured by this approach ranges for different countries from as low as 0% to as high as 50% of the stock price. One of the disadvantages of this approach is that it measures the voting power of the marginal shareholder multiplied by the probability of a control contest. If ownership is concentrated or the market for corporate control is weak, the price differential of dual-class shares strongly underestimates the benefits of control of the major existing shareholders.

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6 Another reason why the value of control of a large block is hard to estimate is that besides control benefits, the accumulation of a large block of shares is also associated with liquidity costs and insufficient diversification. Examples of theoretical models analyzing these issues are Bolton and von Thadden (1998) and Maug (1998). The costs of holding large blocks confound the inference about the value of control, which in most cases is significant only in large blocks.
Dual-class share studies take the existing firm ownership structure as given and then measure control benefits as a function of ownership. A violation of the assumption that ownership is exogenous to control may lead to incorrect inference about the size of the private benefits of control due to the well-known simultaneity bias. Several studies have indeed shown that ownership is endogenously determined by the level of private benefits of control in a company. These theoretical results and empirical findings entail a revisit of the evidence on the size of private benefits of control based on dual-class shares firms or negotiated block transactions. The Bulgarian mass privatization process, the setting studied by the dissertation below, provides a natural solution for the endogeneity of ownership structure and control problem, because the privatization constitutes an exogenous shock to ownership. The ownership structure of all privatized firms is afterwards created from scratch as a result of the investor bidding at the auctions.

The second approach is to document the premium of negotiated block transactions to the market price of publicly traded companies. Barclay and Holderness (1989, 1991), and Bebchuk (1994) show that on average large blocks trade at a premium in the USA, which implies that the private benefits of control dominate the costs of holding large blocks in public corporations. Based on Barclay and Holderness (1989) the control premium if found to be 20% of the stock price of publicly traded US companies. In contrast, Wruck (1989) and Hertzel and Smith (1993) find that large, privately placed

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7 Demsetz and Lehn (1985), Bebchuk (1999), Lamba and Stapledon (2001)
8 Indirect evidence about the control premium can be found in the literature on leveraged buy-outs (LBOs). In an LBO, a group of investors or firm management is willing to pay a substantial premium over the market price to secure control over a company. See for example DeAngelo, DeAngelo, and Rice (1984).
blocks trade at a discount. Consistent with the notion that a large block may not have a large control value but always bears liquidity and undiversification costs, Barclay, Holderness, and Sheehan (2000) suggest that the discount of privately placed blocks (compared to the premium on publicly traded blocks) is caused by the fact that the holders of these blocks are more likely to refrain from active participation in firm governance, and forego the opportunity to gain private benefits of control. A recent cross-country study of Dyck and Zingales (2001) finds that the premium for control in 39 countries ranges from −4% to 65%.

The negotiated block transaction studies require fewer assumptions than the dual-class share studies and measure the value of control of a large shareholder as opposed to small shareholders. They have several problems of their own. The price of a negotiated block transaction provides an estimate for the control benefits of the owner of one large block. The premium for control measured this way is strongly affected by a selection bias because only occasions when a major shareholder decides to sell his stake are observed. The selection bias problem in these studies can be solved only if a theoretical model of investor decision making is developed. The solution of the selection bias problem also requires that there is data on investment decisions to estimate the exact effect of the factors suggested by the model on the buy (sell) decisions of large investors. Both of these requirements are satisfied by the dissertation. Chapter 3 develops the equity investment model that suggests what are the factors to consider when analyzing the choices of large investors. Also, the unique data set of the dissertation contains the universe of all large investors that did or did not submit a bid for shares in a particular
company, which makes possible the empirical estimation of the investment model. The theoretical model and empirical estimation in the dissertation will thus not only extend the theoretical equity valuation research, but also generate bias-free estimates of the value of control.
Chapter 3

OPTIMAL PORTFOLIO INVESTMENTS WITH BENEFITS OF CONTROL

Institutional investors like mutual and pension funds play an important role in the capital markets in most developed countries. A feature of the American institutional framework is that the acquisition of large blocks in publicly traded firms by most financial institutions is costly and in some cases even limited by law\(^9\). If institutions own mostly small blocks of shares, they will have little incentive to actively engage in governing the firms in their portfolios. Therefore, the portfolio decision problem of an American financial institution can be adequately described by classical portfolio theories. The latter focus mainly on diversification, while treating as exogenous to the institution the risk-return characteristics of all existing securities. Besides institutional investors, in the US there are a certain number of wealthy individuals that form portfolios of large blocks and engage in active restructuring of the firms in their portfolios\(^{10,11}\). The assumptions, on which classic portfolio theory is based, make it hard to apply when analyzing the behavior of these large investors.

Outside the US and UK most institutions or wealthy individuals hold large blocks of shares. Large block holdings add additional factors that investors may consider when they make portfolio allocation decisions. This is especially true in emerging markets or

\(^{10}\) Notable examples are Carl Icahn, Boone Pickens, and Warren Buffet.
economies in transition\textsuperscript{12}. For instance, large investors in emerging markets that typically hold controlling blocks of shares may be more likely to invest in firms where they have a comparative advantage in monitoring managers or in extracting private benefits of control. In order to analyze the behavior of large investors in these markets, the established portfolio theory has to be extended to account for corporate governance notions like monitoring ability or the trade-off between liquidity and control\textsuperscript{13}.

This chapter will develop a model that will formalize the ideas proposed in Chapter 2, and will include private benefit of control and monitoring into equity valuation. Afterwards, a solution to the optimal portfolio problem of a large investor with a fixed budget constraint will be presented.

3.1 The model

\textit{Table 3–1} lists all notation. Let the universe include a single large investor \(L\), a continuum of atomistic shareholders that can buy only small blocks, and a total number of \(N\) firms. There are three time periods, \(t = 0\), \(t = 1\), and \(t = 2\). All firms are liquidated at time \(t = 2\). The large investor has a total capital equal to some constant \(C\). Let at time \(t = 0\), the stock price of firm \(i\) be equal to \(P_i\), and the liquidation value of a share in the same firm at \(t = 2\), if the large shareholder does not buy any shares in it, be equal to \(\hat{E}_i\). The

\textsuperscript{11} Other investors that can affect the value of their portfolios are takeover arbitrageurs. By taking a substantial position in a target firm they can influence the outcome of a takeover contest. See for example Cornelli and Li (2001).

\textsuperscript{12} La Porta, Lopez-de-Silanes, and Shleifer (1999) provide evidence that ownership of public companies is especially concentrated in emerging markets.
total number of shares of firm \( i \) is \( S_i \), a known and fixed constant. The shares in all firms are assumed to be infinitely divisible. Let the number of shares that \( L \) buys in firm \( i \) be \( s_i \), and let \( \alpha_i = s_i/S_i \). To make the model non-trivial, the \( L \)'s available capital \( C \) is assumed to be much smaller than the sum of market values of all firms.

3.1.1 Assumptions

The main assumptions of the model are outlined below. The first assumption that is made is that stock supply is infinitely elastic.

Assumption 1. For all \( i = 1 \) to \( N \), the stock price \( P_i \) is fixed and does not depend on the size of the block \( \alpha_i \) that \( L \) decides to buy in firm \( i \).

This assumption is strong. It is made here to keep the baseline model as simple as possible. Consistent with the market microstructure literature on trading costs, this assumption is relaxed in Appendix C. There, the trading environment at time \( t = 0 \) is explicitly modeled and upward sloping supply curves are built into the model.

Next, I assume that the only random variables from the point of view of \( L \) are the last period firm liquidation values. The following assumption is made about the distribution of firm liquidation values:

Assumption 2. The liquidation values \( \hat{E}_i \) of firms \( i = 1 \) to \( N \) are distributed multivariate normal with a mean equal to \( E \), a vector with a typical element \( E_i \), and a variance-

\[ \text{See for example Shleifer and Vishny (1997), Bolton and von Thadden (1998a, 1998b), and Maug (1998) among many others.} \]
covariance matrix $V^{14}$. The vector $E$ and the matrix $V$ are known \textit{ex ante} and independent of $L$’s actions.

A major restriction introduced with Assumption 2 is that the variance-covariance matrix of returns is exogenous to the ownership structure of firms. Relaxing this restriction is not conceptually difficult but notationally cumbersome. In Chapter 7, I briefly discuss an extension of the model that incorporates this possible feature of the economy.

Similar to the model in APZ, $L$ can increase firm value at time $t = 2$ by monitoring firm managers and reducing the agency costs associated with their imperfectly aligned incentives. The level of monitoring is denoted by $m_i$. The benefits from monitoring are denoted by the function $\mu_i(\alpha_i, m_i)$. Monitoring is costly for the large shareholder. This is captured by the cost function $c_i(\alpha_i, m_i)$. The following is assumed about the functions $\mu_i(\alpha_i, m_i)$ and $c_i(\alpha_i, m_i)^{15}$:

\textit{Assumption 3.} The functions $\mu_i(\alpha_i, m_i)$ and $c_i(\alpha_i, m_i)$ are continuous and twice differentiable with respect to $m_i$ and satisfy for all $i = 1$ to $N$: 

\begin{align*}
    c_i(\alpha_i, 0) &= 0, \quad \partial c_i(\alpha_i, m_i)/\partial m_i \geq 0, \\
    \mu_i(\alpha_i, 0) &= 0, \quad \partial \mu_i(\alpha_i, m_i)/\partial m_i \geq 0 \\
    \alpha_i \mu_i(\alpha_i, m_i) - c_i(\alpha_i, m_i) \text{ is a globally concave function in } m_i.
\end{align*}

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14 The normal distribution may not be a good approximation to firm values because all $E_i$ are bounded from below by 0. Instead, lognormally distributed firm values can be used at the cost of introducing substantial mathematical complexity in the portfolio selection problem. See, for example, Ohlson and Ziemba (1976) for a solution of the classic portfolio optimization problem with lognormal returns and a power utility function.

15 A similar set of assumptions about the monitoring technology is used by APZ.
Assumption 3 assures that the solution for optimal level of monitoring $m_i$ exists and is well defined. A further simplification can be made if we assume that monitoring is “allocation-neutral”. An allocation-neutral monitoring is defined by APZ as a monitoring technology, where for all $m_i$ the functions $\mu(\alpha_i, 0)$ and $c_i(\alpha_i, m_i)$ do not depend on the level of ownership $\alpha_i$. Formally this is expressed in the following assumption:\(^{16}\):

**Assumption 3a.** The functions $\mu(\alpha_i, m_i)$ and $c_i(\alpha_i, m_i)$ are such that for all $m_i \geq 0$:

$$\frac{\partial c_i(m_i, \alpha_i)}{\partial \alpha_i} = 0, \frac{\partial \mu_i(m_i, \alpha_i)}{\partial \alpha_i} = 0$$

APZ show that the cost function can be redefined in such a way that without loss of generality the function $\mu_i(\alpha_i, m_i)$ can be equal to $m_i$. This simplifies notation. Because monitoring is assumed to bring a fixed dollar increase in firm value, it is reasonable to assume that the costs of monitoring for a given dollar increase in firm value are decreasing in firm size\(^{17,18}\). This is introduced by the following assumption.

**Assumption 3b.** The functions $c_i(\alpha_i, m_i)$ are such that for all $i = 1$ to $N$, and all $m_i \geq 0$,

$$\frac{\partial c_i}{\partial S_i} < 0$$

In addition to receiving monitoring benefits, a large shareholder can also utilize his voting power to secure private benefits of control. If $L$ has a large enough block in a

\(^{16}\) APZ, p. 1105

\(^{17}\) Note that in APZ all firms are identical in terms of size so the authors can ignore any economies of scale in monitoring.

\(^{18}\) Demsetz and Villalonga (2001) note that monitoring may generate more value in riskier firms. A natural extension motivated by this note is to make monitoring costs a decreasing function in firm risk.
firm, $L$ can get control over how firm value is distributed. In particular, $L$ can divert a part of firm cash flows equal to $\theta_i$ and distribute the remaining cash flows as dividends. The diversion of cash flows into private benefits of control is modeled as being inefficient. This can be either because there is a positive probability that $L$ can be caught and has to pay a fine proportional to the amount of diversion (similar to Shleifer and Wolfenzon (2000)), or because diversion activities like transfer pricing can be subject to large transaction costs or excessive taxes. The fact that $L$ cannot appropriate the full diverted amount $\theta_i$ is captured by the function $b_i(\theta)$. The following assumption is made about $b_i(\theta)$.\(^{19}\)

Assumption 4. The function $b_i(\theta)$ for all $i = 1$ to $N$ is everywhere twice continuously differentiable and satisfies:

$$b_i(0) = 0, \quad b_i'(0) = 1, \quad b_i'(1) = 0, \quad \text{and} \quad b_i''(\bullet) < 0$$

These properties of $b_i(\theta)$ assure the existence of an interior solution for the optimal $\theta_i$.

$L$ will be able to get control of a firm depending on $\alpha_i$, the size of his block in the firm. The takeover literature usually assumes that if $L$ owns more than 50% of firm shares, $L$ will have control of the firm for sure. For blocks of size smaller than 50% there is no unique way to define what is the probability of $L$ taking control of the firm. To model the relationship between block size and the ability to get full control of a firm, I introduce a function $p(\alpha_i)$ that may be interpreted as either the probability of acquiring

\(^{19}\) As mentioned in Chapter 2, the same extraction technology is used by Burkart, Gromb and Panunzi (1998) and Bennedsen and Wolfenzon (2000)
full control over firm cash-flows, or the share of the proceeds that \( L \) will get as a member of a coalition of shareholders that acquires full control of a firm\textsuperscript{20}. Assumption 5 outlines the properties of the function \( p(\alpha_i) \).

**Assumption 5.** The function \( p(\alpha_i) \) satisfies the following:

\[ p(0) = 0, \quad p(\alpha_i) = 1 \quad \text{for} \quad (\alpha_i) \in [0.5, 1] \]

For all \( \alpha_i, \alpha_i \in [0, 1] \), \( p(\alpha_i) \leq p(\alpha_i^*) \Leftrightarrow \alpha_i \leq \alpha_i^* \)

For the rest of the paper, \( p(\alpha_i) \) will be equal to an indicator function equal to 1 if \( \alpha_i \in [0.5, 1] \) and 0 otherwise\textsuperscript{21}.

To simplify the model structure the following independence assumption is made.

**Assumption 6.** The functions \( c_i(m_j), b_i(\theta_j), \text{and} \ p(\alpha_i) \) are such that for each firm \( i \), none depend on the values of \( m_j, \theta_j, \text{and} \ \alpha_i \) for all \( j \neq i \).

Assumption 6 states that the interdependence between blocks in more than one firm may only come through their combined effect on the overall risk of \( L \)'s portfolio.

Chapter 7 contains a brief discussion of possible extensions of the model that may relax this independence assumption. This assumption rules out a monitoring budget constraint.

\textsuperscript{20} Consider an example where \( L \) holds a stake \( (\alpha_i) < 0.5 \) and forms a coalition with a set of shareholders that hold a total stake of \( (0.5 - \alpha_i) \). The coalition gets control over firm \( i \), and then splits the proceeds from this control to each of its members. The rule for splitting the proceeds is that each member gets a share of the private benefits of control proportional to her stake. In this case \( p(\alpha_i) = 2\alpha_i \) for \( \alpha_i < 0.5 \), and \( p(\alpha_i) = 1 \) for \( \alpha_i \in [0.5, 1] \). The discussion in Section 2 about power indices like the Shapley-Shubik Banzhaf-Coleman index suggests other functional forms for \( p(\alpha_i) \). These can be incorporated in the analysis.

\textsuperscript{21} To avoid an open set problem, I assume that a block of exactly 50% is enough to obtain full control.
Other cases where it may be violated include synergies between firms or the ability to engage in transfer pricing if $L$ has control simultaneously of a firm and its suppliers.

$L$ is assumed to maximize the expected utility of his wealth $W$ at the last period $t = 2$. The following assumption is made about the form of $L$’s utility function:

**Assumption 7.** The utility function of $L$ is of the following form:

$$u(W) = -e^{-\rho W}$$

where the coefficient of absolute risk aversion $\rho$ is greater than 0.

This type of constant absolute risk aversion utility function is a tractable way to introduce risk aversion in $L$’s preferences because with normally distributed terminal wealth, maximizing expected utility is equivalent to maximizing the certainty equivalent 3.1.

$$E[W] - \left( \frac{\rho}{2} \right) Var(W)$$  \hspace{1cm} (3.1)

Last, I assume that no borrowing is allowed. The unfeasibility of infinite borrowing at a risk-free rate is a feature of all real world settings and is required in order for the budget constraint of $L$ to be binding.

The timing of events in the model is as follows. At time $t = 0$, $L$ buys blocks $\alpha_i$ in some of the firms. At time $t = 1$, given $\alpha_i$, the large shareholder chooses the levels of $m_i$ and pays the cost $c_i(\alpha_i, m_i)$. At time $t = 2$, the liquidation value of all firms is revealed. Depending on the choice of stakes $\alpha_i$ at time $t = 0$ and the form of the function $p(\alpha_i)$, $L$
has acquired control in some firms. In the firms where $L$ has full control, he chooses the level of diversion $\theta_i$, and gets $b_i(\theta_i)$ for himself. The remaining part of the cash flows is distributed as dividends to all equity owners.

### 3.1.2 Specification of the program and solution for $\theta_i$ and $m_i$

The optimal portfolio allocation that maximizes $L$’s expected utility is the solution to the following non-linear programming problem 3.2 - 3.6:

$$\max_{\alpha_i, m_i, \theta_i} \sum_{i=1}^{N} \left[ (E_i S_i + m_i) \alpha_i + p_i [b_i - \theta_i \alpha_i] (E_i S_i + m_i) - c_i \right] - \frac{\rho}{2} w^T V w $$ \hspace{1cm} (3.2)

subject to, for all $i = 1$ to $N$

$$\sum_{i=1}^{N} P_i S_i \alpha_i \leq C$$ \hspace{1cm} (3.3)

$$0 \leq \alpha_i \leq 1$$ \hspace{1cm} (3.4)

$$0 \leq \theta_i \leq 1$$ \hspace{1cm} (3.5)

$$0 \leq m_i$$ \hspace{1cm} (3.6)

where $w$ is a vector with a typical element $w_i = \{s_i (1 - p_i \theta_i) + p_i b_i S_i \}$, and denotes the contribution of each investment in firm $i = 1$ to $N$ to the overall variance of $L$’s wealth.

Compared to classical mean-variance optimization, the above problem has several novel features. Private benefits of control in a firm can be obtained only if the ownership

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22 For notational simplicity no explicit discounting is introduced. All cash flows are
stake of $L$ is large enough. This will bias the optimal portfolio allocation towards holding large blocks in a smaller number of firms, as compared to the benchmark case where $\theta_i = 0$. The private benefits of control may depend on the ownership stake in a discontinuous fashion. For example, an ownership stake of 50% may be a lot more valuable than an ownership stake of 49.9%. The budget constraint of $L$ and the market value of the firms become crucial for the solution. Depending on the amount of her available capital, the large investor may decide to buy large blocks in smaller firms in order to maximize the value of the private benefits of control and reduce the level of portfolio risk.

The following analysis outlines some features of the optimal solution of 3.2 - 3.6. Because of the sequential nature of $L$’s choice (first pick $\alpha_i$, then $m_i$, and then $\theta_i$), the solution can proceed in the reverse order. First, the optimal values of $\theta_i$ are found taking the values of $\alpha_i$ and $m_i$ as given. Then, the optimal values of $m_i$ are found based on the last period optimal values of $\theta_i$ and taking for given the values of $\alpha_i$. Lemma 1 shows the optimal solution for $\theta_i$, while Lemma 2 shows the optimal solution for $m_i$. Afterwards, the program is rewritten as a constrained maximization of a function only in $\alpha_i$.

**Lemma 1.** The optimal solution of $\theta_i$, for all $i = 1$ to $N$ is given by:

$$\theta_i^* = b_i^{-1} (\alpha_i) \quad (3.7)$$

where $b_i^{-1}$ denotes the inverse function of the first derivative of $b_i(\theta)$. 

assumed to be nominated in $t=2$ dollars.
Lemma 1 has two important implications summarized in Corollary 1. Let’s denote by $\pi_i^*$ the net gain from private benefits of control, $\pi_i^* = b_i(\theta_i^*) - \alpha_i \theta_i^*$.

**Corollary 1.**

(i) The optimal level of $\theta_i$ is a decreasing function of the size of the block $\alpha_i$.

(ii) The net gain from control $\pi_i^*$ is a decreasing function of $\alpha_i$.

Proof: See Appendix A.

The statements in Corollary 1 are intuitive. If $L$ has a larger block in a firm, $L$ will be internalizing to a greater extent the dead loss from diverting firm value into private benefits of control. At the extreme, when $\alpha_i = 1$, the net gain from control is equal to 0.

After finding the optimal value for $\theta_i$, we can proceed and find the optimal values of $m_i$ that $L$ will choose at time $t = 1$, given his existing ownership blocks $\alpha_i$, and the fact that he will choose the optimal value of $\theta_i$ at time $t = 2$. Lemma 2 presents the solution for optimal monitoring levels.

**Lemma 2.** The optimal solution for $m_i$, for all $i = 1$ to $N$ is given by 3.8 and 3.9:

\[
m_i^* = c_i^{-1}(\alpha_i) \quad \text{for} \quad \alpha_i \in [0,0.5) \quad (3.8)
\]

\[
m_i^* = c_i^{-1}(\alpha_i + \pi_i^*) \quad \text{for} \quad \alpha_i \in [0.5,1] \quad (3.9)
\]
where \( c_i^{-1} \) denotes the inverse function of the first derivative of \( c_i(\theta_i) \).

Proof: See Appendix A.

The optimal solution of the level of monitoring changes in a discrete manner depending on whether \( L \) has control or not. The striking result is that whenever \( L \) has control in a firm and private benefits of control exist, \( L \) will spend disproportionally more resources on monitoring this firm. This result is discussed in further detail when the empirical predictions of the model are outlined in Chapter 3.3. A similar finding appears in Bebchuk and Jolls (1999), where managers spend more effort if they expect to consume more private benefits.

### 3.1.3 Effects on the value of shares of small shareholders from the existence of a large investor

It is worth exploring the effects on small shareholders wealth after \( L \) buys a controlling block in a firm. There are two competing effects. The first effect is the increase in firm value from the monitoring activities of \( L \) at \( t = 1 \). In a firm with one large owner, managers will be strictly monitored and firm value will increase. The second effect is the diversion of a part of last period firm value associated with private benefits of control that accrue only to \( L \). This effect is detrimental to small shareholders. The relationship between small shareholder value and the ownership structure is illustrated below for particular functional forms of the diversion and monitoring technology. The

\[ 23 \] Corollary 1 corresponds to identical results in Burkart, Gromb, and Panunzi (1998) and Bennedsen and Wolfenzon (2000).
chosen functional forms are introduced in the following refinements of Assumption 3 and Assumption 4.

Assumption 3c. The function $c_i(m_i)$ is given by 3.10:

$$c_i = \frac{\gamma_i m_i^2}{2S_i}, \text{where } \gamma_i > 0$$  \hspace{1cm} (3.10)

Assumption 4a. The function $b_i(\theta_i)$ is such that:

$$b_i(\theta_i) = \theta_i - \frac{\theta_i^2}{2}$$  \hspace{1cm} (3.11)

Given Assumptions 3c and 4a, the following Lemma shows the combined effect of monitoring and diversion on small shareholder wealth.

Lemma 3. The net effect per share from the existence of a controlling shareholder for small shareholders in a firm $i = 1$ to $N$ is given by 3.12:

$$g_i(\alpha_i) = \left(1 + \frac{\alpha_i}{2\gamma_i}\right)\alpha_i - (1 - \alpha_i)E_i$$  \hspace{1cm} (3.12)

Proof: See Appendix A.

The net gain for small shareholders from the existence of a controlling shareholder is positive for a large subset of parameter values. This is consistent with a number of studies that find that majority and other large shareholders have a positive or neutral effect on the value of minority holdings in the USA\textsuperscript{24}. The size of the net gains

\textsuperscript{24} Barclay and Holderness (1989) and Holderness and Sheehan (1988) among others
depends on the size of the block of the controlling shareholder, the costs of monitoring, and the return of the firm under dispersed ownership. These relationships are formalized in Corollary 2.

**Corollary 2**: The function $g_i$ has the following properties for all $\alpha_i \in [0.5, 1)$ and all $i = 1$ to $N$:

(i) $\frac{\partial g_i}{\partial \alpha_i} > 0$

(ii) $\frac{\partial g_i}{\partial \gamma_i} < 0$

(iii) $\frac{\partial g_i}{\partial E_i} < 0$

Proof: See Appendix A.

Minority shareholders are better off if $L$ has an ownership in the firm that is as large as possible. Blocks of the minimum necessary size to have full control are detrimental to minority shareholder wealth. The result that firm value and correspondingly small shareholders wealth is increased when monitoring costs are low is straightforward. The last result is that small shareholders are worse off in firms that have *ex ante* high returns. In such firms on one hand, $L$ does not bring a lot of improvement through monitoring, and on the other hand, diverts more resources to private benefits of control. In contrast, in poor performing firms the benefits for small shareholders from the existence of a controlling shareholder are large compared to the costs.
3.1.4 Final formulation of \( L \)'s optimization problem

Chapter 3.1.2 established the optimal levels of monitoring and private benefits of control as functions of the ownership stakes \( \alpha_i \) that \( L \) has acquired at time \( t = 0 \). The program described in 3.2 - 3.6 can be now reformulated as a constrained maximization problem that involves only the ownership stakes \( \alpha_i \). \( L \) has to solve 3.13:

\[
\max_{\alpha_i} \sum_{i=1}^{N} \left( [E_i S_i + m_i^* (\alpha_i + p_i \pi_i^*) - c_i (m_i^*)] - \frac{\rho}{2} w^T V w \right)
\]

s.t.

\[
\sum_{i=1}^{N} P_i S_i \alpha_i = C
\]

\[\alpha_i \in [0,1]\]

where the vector of weights has a typical element \( w_i = (\alpha_i + p_i \pi_i^*) S_i \).

The general model leads to a highly nonlinear and discontinuous function in \( \alpha_i \).

The program can be solved using “branch and bound”, dynamic programming, or other algorithms for mixed integer optimization problems. The numerical solution of the general model is left to future work. In the next Chapter 3.2, a special case is considered that simplifies the program and can be solved using well-developed integer programming algorithms.
3.2 A special case of the model

This chapter of the dissertation introduces a special case of the model where monitoring is not feasible. The endogeneity of portfolio returns is due only to the private benefits of control. A real-world setting that corresponds closely to this special case is the process of privatization in East Europe. After the privatization most of the resulting controlling shareholders were former managers or privatization funds whose founders had very short horizons. These investors cared mostly about expropriating as much as possible of the assets of the acquired firms without spending any effort in reorganization or governance25.

3.2.1 Model description and theoretical results

The setting of the simplified model is as follows. There are $N$ firms with stock prices at time $t = 0$ all equal to 1, and identical expected liquidation values equal to $E$. $V$ is a diagonal matrix with diagonal elements equal to the same constant $\sigma^2$.26 Monitoring benefits are equal to 0 for all $\alpha_i$. The variables that differ across firms are firm size $S$, and net gains from the private benefits of control $\pi^*$. Without loss of generality, let $C = 1$. The optimal portfolio without private benefits of control is given in Lemma 4.

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26 The assumption that the matrix $V$ is diagonal (firm returns are not correlated) is crucial for the analysis because portfolio risk becomes a separable function in the risk of each investment. This is a necessary condition for the formulation of the Knapsack Problem below. As is shown below, this assumption is not as restrictive as it seems. It is equivalent to assuming that returns are correlated only through a common market factor similar to Sharpe (1963).
Lemma 4. If private benefits of control do not exist, the optimal portfolio satisfies for all $i = 1$ to $N$:

(i) $w_i = \frac{1}{N}$

(ii) $E(R_p) = E - 1$

(iii) $\sigma_p^2 = \frac{\sigma^2}{N}$

Proof: See Appendix A.

Note that the expected return and variance of the optimal portfolio do not depend on firm size. Next, we introduce $\pi_i^* > 0$. Before proceeding to the solution concept, Lemma 5 reduces significantly the set of values for $\alpha_i$ that should be considered as potential optimal solutions, when private benefits of control are possible to obtain.

Lemma 5. If a portfolio is optimal, then for all $i = 1$ to $N$, $\alpha_i^* \leq 0.5$.

Proof: See Appendix A.

The intuition behind this lemma is that, if there is no monitoring, nothing is gained if a block size is increased beyond 0.5. On the other hand, the risk is increased and the net gains from control $\pi_i^*$ are reduced because it becomes more costly for $L$ to divert inefficiently some of the cash flows of the firm. Lemma 5 reduces the search for optimal values to deciding in what firms $L$ will buy a minimal majority block. After these firms are found, $L$ places the remaining capital in a portfolio given by Lemma 4, which is roughly equivalent to a risk-free asset.
Consider a firm $i$, such that $\alpha_i^* = 0.5$. The return on an investment in this firm, as is shown in Appendix A, is $R_i = E - 1 + 2E\pi_i^*$. The excess return of this firm multiplied by its portfolio weight $w_i$ ($w_i = (0.5S_i/C) = 0.5S_i$) is given by 3.14:

$$r_i = S_iE\pi_i \quad (3.14)$$

The contribution of this investment to portfolio risk is given by 3.15:

$$\sigma_i^2 = (0.5S_i)^2(1 + 2\pi_i)^2\sigma^2 \quad (3.15)$$

Denote by $v_i$ the contribution of an investment in a firm $i$ to the expected utility of $L$ as proxied by the certainty equivalent 3.1. Given the utility function in Assumption 7, the expression for $v_i$ is:

$$v_i = r_i - \frac{\rho}{2} \sigma_i^2 = S_iE\pi_i - \frac{\rho}{8} S_i^2(1 + 2\pi_i)^2\sigma^2 \quad (3.16)$$

$L$ is assumed to maximize expected utility subject to his budget constraint. Maximizing expected utility involves a discrete decision for each firm to buy a majority block or a small block. If a majority block is bought in firm $i$, $L$ will get an increase in his certainty equivalent equal to $v_i$ and the available capital will be reduced by $0.5S_i$. The problem that $L$ must solve is called the “Knapsack Problem” (KP). It is one of the most well studied problems in integer programming.

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27 The same result can be derived if the monitoring technology $m_i$ can take only two values: 0 and $m_h$. If monitoring costs are such that $L$ will choose $m_h$ only if $\alpha_i \geq 0.5$, then increasing block size beyond 0.5 brings no additional benefits.

28 The formulation of the original Knapsack Problem is as follows. A tourist has a knapsack that has a certain fixed weight capacity. The tourist has to decide what items of
Formally, $L$ solves the program 3.17 - 3.18:

$$\max \sum_{i=1}^{N} v_i x_i$$  \hspace{1cm} (3.17)$$

$$\text{s.t.} \sum_{i=1}^{N} S_i x_i \leq 2C$$  \hspace{1cm} (3.18)$$

where $x_i$ is an indicator variable that is equal to 1 if $L$ buys a majority block in firm $i$, and 0 otherwise.

The following proposition describes an important feature of the optimal solution of the problem 3.17 - 3.18.

**Proposition 1.** The optimal portfolio of $L$ is more likely to include majority blocks in firms that have a higher value-per-size ratio. The value-per-size ratio is given by $v_i / S_i$, where:

$$\frac{v_i}{S_i} = E\pi_i - \frac{P}{8} S_i (1 + 2\pi_i)^2 \sigma^2$$  \hspace{1cm} (3.19)$$

Proof: See Appendix A.

The value-per-size ratio is conceptually similar to the “appraisal ratio” of Treynor and Black (1973). In the active portfolio management model of Treynor and Black (1973), the decision to include a stock depends on the ratio of its excess return over idiosyncratic risk. The value-to-size ratio illustrates the same idea of investing in the securities with the highest return per unit risk. It compares the increase in expected different value to put in the knapsack in order to maximize the sum of values of all items included in the knapsack while not overweighing the knapsack.
returns due to private benefits of control with the increase in portfolio risk due to taking a large position while satisfying a budget constraint.

Firm size and private benefits of control appear as extra factors to consider when engaging in active portfolio management. The effect of these two factors on the probability of a firm being included in $L$’s optimal portfolio is formalized by Corollary 3.

**Corollary 3.** The value-per-size ratio is a decreasing function in firm size. For most feasible values of $\rho$ and $\sigma^2$, the value-per-size ratio is an increasing function in the net gain from control. Formally the following is true:

$$\frac{\partial}{\partial S_i} \left( \frac{v_i}{S_i} \right) < 0,$$

(i)  

$$\frac{\partial}{\partial \pi_i} \left( \frac{v_i}{S_i} \right) > 0,$$

(ii)  for most economically meaningful parameter values

Proof: See Appendix A.

Corollary 3 formalizes the intuitive result that in solving the portfolio allocation problem $L$ has to compare the relative benefits of each firm with its size. For any reasonable values of $\rho$ and $\sigma^2$, the relative benefits increase with the private benefits of control, while firm size imposes costs both through tightening of the budget constraint, and an increase in portfolio risk$^{29}$.

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$^{29}$ Demsetz and Villalonga (2001) mention that the risk of a company may affect its ownership structure. This relationship is also evident in the value-to-size ratio, which is a decreasing function of $\sigma_i$. In other words, the decision of $L$ to buy a controlling block in a firm is negatively correlated with firm risk.
An important result of Treynor and Black (1973) is that the correlation between returns through a common market factor does not affect the weights of the optimal investment portfolio. This implies that the assumption of a diagonal variance-covariance matrix of returns can be replaced with a return structure where the return on every asset is a function of several common factors and an error term that is “almost independent” of the error terms of all other assets. In a world with such return structure, Proposition 1 and Corollary 3 will hold without any changes. The only difference is that the capital remaining after all controlling blocks have been bought will be invested in the market index instead of the quasi risk-free portfolio of Lemma 4.

3.2.2 Numerical results

The above analysis describes how should $L$ approach the problem of maximizing utility while attempting to buy as many majority blocks as possible given her budget constraint. The nature of the problem does not allow for a closed-form solution given the budget of $L$ and the vectors of firm size and private benefits of control. The lack of a closed-form solution does not restrict the analysis, because for the last 30 years a variety of fast numerical algorithms that solve the classic KP problem have been developed. In the remainder of Chapter 3.2.2, I report the outcomes of a plethora of simulated portfolio problems and explore whether several expected relationship are supported by the numerical results. A description of the actual computations is included in Appendix B.

30 The “almost independent” assumption is formally defined in Treynor and Black (1973)
3.2.2.1 Determinants of the probability of a majority block in a particular firm to be included in L’s portfolio

The model predicts that the probability of a majority block in a firm to be included in L’s portfolio is determined by the private benefits of control in the firm ($\pi_i^*$) and its market value of equity ($S_i$). These predictions are investigated using data generated as described in Appendix B. The results from the estimation of a logit model of the probability of L buying a majority block in a firm are reported in Table 3–2. The effect of $S_i$ and $\pi_i^*$ on the attractiveness of a firm as a controlling block investment is strong. A one standard deviation increase in the private benefits of control in a firm results in a 8-fold to 17-fold increase of the probability of L to buy a majority block in this firm. The results of Table 3–2 confirm the intuition behind Proposition 1 and show that, indeed, factors that have been omitted by classical portfolio theory may be important for the portfolio allocation decisions of strategic investors.

3.2.2.2 Portfolio expected return and variance

L is not forced to allocate his entire budget to buying majority blocks. Some of the capital can be allocated to the pseudo risk-free portfolio outlined in Lemma 4 (or the market index in a model with extended return structure). By changing the maximum percentage $\phi (\phi \in [0,1])$ of capital that is invested in majority blocks, L can trace a curve, each point on which is a plot of the return and variance of a portfolio that has $\phi$ capital allocated to the optimal portfolio solving the program 3.17 - 3.18 and $(1-\phi)$ invested in the risk-free portfolio of Lemma 4. The plot of this pseudo capital allocation line is
shown in Figure 3–1. As $\phi$ increases, the expected return and risk of $L$’s optimal portfolio increase. Portfolio return increases almost linearly in $\phi$. Portfolio variance is a concave function in $\phi$. Figure 3–1 shows that certain “prudent man” regulations that limit the amount of capital that an institutional investor can allocate to buying large blocks can effectively reduce the risk of a portfolio. The cost of these regulations is that the return on the portfolio is decreased even more. As we will see below, any exogenous limit to the amount of capital allocated to buying large blocks strictly reduces $L$’s expected utility.

Figure 3–2 illustrates another feature of the problem – the efficient frontier constructed by a large investor strictly dominates the efficient frontier of a small investor. Figure 3–2 plots the portfolio return and variance of investors with different capital that use as much as possible of their capital to buy majority blocks in firms. The striking result is that portfolio variance is an inverse U-shaped function of the total available capital. After a certain critical point portfolio risk is strictly decreasing as investors get wealthier. Portfolio returns of investors with more capital are much higher than the returns of smaller investors. In other words, wealthier investors are better off on both dimensions – they enjoy higher returns and lower risk.

3.2.2.3 Expected utility for different economies and budget constraints

Next, I analyze the relationship between the expected utility (measured by the certainty equivalent) of holding a portfolio, the percentage of capital allocated to buying large blocks, and the average private benefits of control of firms in the economy. The results reported in Table 3–3 show that expected utility is strictly increasing in the
amount of capital allocated to buying large blocks. This result can be explained intuitively by the notion that a large investor holds an option of buying a controlling block in each firm. $L$ will buy a majority block in a firm $i$ only if the incremental effect of this investment on his utility is positive. If more capital is allocated to buying large blocks, the number of options increases because $L$ can afford to buy large blocks in more firms and in firms with larger market capitalization. Given the premises of the model, an investor is better off if he allocates all his available capital to buying large blocks of shares.

Another result in Table 3–3 is that an increase in the average level of private benefits of control in the economy has a large positive effect on the expected utility of an investor that can secure controlling blocks in some firms. An increase in the average private benefits of control increases expected utility in two ways. First, a higher level of private benefits of control puts more firms in the set of firms that have a positive incremental certainty equivalent and can be considered by $L$ as possible investments. Second, the incremental certainty equivalent of the firms that $L$ chooses to invest in is increased.

### 3.3 Empirical predictions

This chapter outlines the main empirical predictions that result from the model. Support for the predictions is found in extant research. The predictions are also strongly supported by the numerical analysis in the previous chapter.
Prediction 1. The level of optimal monitoring is larger in firms where L has total control. In the set of firms where L has total control, the level of monitoring is larger in firms with larger private benefits of control.

This prediction follows directly from Lemma 2 and the fact that $\pi_i^* > 0$ at the optimal level of diversion. The result is similar to a proposition in APZ that a large shareholder is more likely to monitor more in a setting where she can bargain over the surplus from her monitoring with small shareholders. A framework that tests this prediction is to relate measures of monitoring activity or owner-manager agency costs (management turnover, accounting measures of performance, etc.) with measures of private benefits of control like the price differential of dual-class shares.

Prediction 2. L is more likely to acquire blocks in firms with larger private benefits of control.

This prediction is a result from Corollary 3. Firms with large private benefits of control are valuable investment opportunities for wealthy individuals or non-US institutional investors. Such firms are likely to have a single majority shareholder or a controlling syndicate. This prediction is best tested in an environment where no initial controlling shareholders exist, or if controlling shareholders exist, they have no bargaining power and do not maximize the profits from the sale of their stakes. One example of such setting is the process of mass privatization undertaken by most ex-Socialist countries. There, the governments divested through auctions their ownership in a large number of firms. Some of the privatization schemes even encouraged the creation of large owners.
Prediction 3. The probability of L buying a controlling block in a particular firm is decreasing with firm size $S_i$. Large firms are less likely to have concentrated ownership.

This is another result from Corollary 3 and is also consistent with the findings in Table 3–2. Small firms are preferable candidates for a controlling block investment because they will have lower portfolio weight and contribute to lower portfolio risk. This prediction is supported by studies like Demsetz and Lehn (1985) that find that the size of the largest block in US firms is decreasing as firm size increases.

Prediction 4. The value of minority shareholder shares is increasing in the block size of the controlling shareholder, and decreasing in asset size, previous firm performance and the size of the private benefits of control.

This prediction comes from Corollary 2. A way to test it is to analyze large block transactions similar to Barclay and Holderness (1989). The data has to be explored to find whether the size of the block is positively correlated with the cumulative abnormal return around the announcement of the trade. Similarly, if the analysis finds that the size of the existing assets of the firm, previous performance and proxies for the private benefits of control are negatively correlated with the price reaction at the announcement date, this will be evidence consistent with Prediction 4.

Prediction 5. The probability of an investor buying large blocks in firms is increasing in the size of the investor’s budget.

This is a straightforward conclusion from the analysis of the investor optimal portfolio problem. Large blocks are feasible only if an investor has substantial capital.
Moreover, blocks of a given size contribute less to the risk of a large portfolio because they have smaller weights.

*Prediction 6. The expected return of a portfolio is an increasing function in the proportion of capital invested in large blocks. Portfolio risk is an increasing function in the proportion of capital invested in large blocks.*

This prediction follows directly from the expressions of portfolio return and risk as functions of the amount of capital invested in majority blocks. On one hand, the expected return on investments in controlling blocks is much higher than the return in small blocks. On the other hand, large blocks add more idiosyncratic risk to the portfolio.

*Prediction 7. The efficient frontier constructed by a large investor dominates the frontier of a small investor.*

An important result from classical portfolio theory states that the efficient frontier is the same for all investors, regardless of their preferences or wealth. Relaxing the assumption that returns do not change with block size leads to a violation of the fund separation property. The efficient frontier differs for different investors based on their wealth. Large investors can afford to buy controlling blocks and earn abnormal returns, while small investors have to accept the fact that they will always earn lower returns than the majority shareholders of the firms where they invest in. Prediction 7 states that large investors that engage in trading of controlling blocks will have better risk-adjusted performance than small individual investors or diversified mutual funds. In the US, the prediction can be tested by comparing the return distributions of venture capitalist funds or corporate raiders with the return distributions of individual investors or mutual funds.
After developing several predictions from the portfolio model in Chapter 3, the following Chapters 4 to 6 present empirical tests of some of these predictions.
### Table 3–1: Notation

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T)</td>
<td>Time index. Equal to 0, 1 or 2</td>
</tr>
<tr>
<td>(i)</td>
<td>Firm subscript. Equal to 1 … (N)</td>
</tr>
<tr>
<td>(L)</td>
<td>The single large investor</td>
</tr>
<tr>
<td>(C)</td>
<td>(L)’s budget (capital) at time (t = 0)</td>
</tr>
<tr>
<td>(P)</td>
<td>A vector with a typical element (P_i) denoting firm stock prices at time (t = 0)</td>
</tr>
<tr>
<td>(E)</td>
<td>Vector with a typical element (E_i) denoting liquidation value of all firms if (L) does not buy any shares in them. Distributed as multivariate normal.</td>
</tr>
<tr>
<td>(E)</td>
<td>Vector with a typical element (E_i) denoting the expected liquidation value of all firms if (L) does not buy any shares in them</td>
</tr>
<tr>
<td>(V)</td>
<td>A positive semi-definite matrix denoting the variance-covariance matrix of firm liquidation values</td>
</tr>
<tr>
<td>(S)</td>
<td>Vector with a typical element (S_i) denoting the total number of shares in each firm.</td>
</tr>
<tr>
<td>(s_i)</td>
<td>Number of shares that (L) buys in firm (i)</td>
</tr>
<tr>
<td>(\alpha_i)</td>
<td>(L)’s block size in firm (i) as percent of firm equity. Equals (s_i/S_i)</td>
</tr>
<tr>
<td>(m_i)</td>
<td>Level of monitoring chosen by (L) in firm (i)</td>
</tr>
<tr>
<td>(\mu(\alpha_i, m_i))</td>
<td>An increasing function in its argument (m_i) and non-increasing in its argument (\alpha_i). Measures the increase in firm value due to (L) spending (m_i) effort on monitoring</td>
</tr>
<tr>
<td>(c(\alpha_i, m_i))</td>
<td>Cost function of monitoring</td>
</tr>
<tr>
<td>(\theta_i)</td>
<td>A constant between 0 and 1 measuring the part of last period firm (i) value that is diverted by (L)</td>
</tr>
<tr>
<td>(b_i(\theta_i))</td>
<td>An increasing and concave function in its argument (\theta_i) that measures (L)’s private benefits of control if (L) diverts (\theta_i)</td>
</tr>
<tr>
<td>(p_i(\alpha_i))</td>
<td>A weakly increasing function in its argument that measures the level of control that (L) can achieve in firm (I_i) if (L) buys a block equal to (\alpha_i).</td>
</tr>
<tr>
<td>(w_i)</td>
<td>Weight of an investment in the portfolio</td>
</tr>
<tr>
<td>(\pi_i)</td>
<td>Net gain of control as percent of firm value. Equal to (b_i(\theta_i) – \theta_i(\alpha_i))</td>
</tr>
<tr>
<td>(W)</td>
<td>(L)’s wealth at time (t = 2)</td>
</tr>
<tr>
<td>(\rho)</td>
<td>The level of absolute risk aversion of (L). (\rho &gt; 0)</td>
</tr>
<tr>
<td>(G_i)</td>
<td>Change in firm value for minority shareholders after (L) buys a controlling block</td>
</tr>
<tr>
<td>(g_i)</td>
<td>Net gain per share for minority shareholders after (L) buys a controlling block</td>
</tr>
<tr>
<td>(R_i)</td>
<td>The return on an investment in firm (i).</td>
</tr>
<tr>
<td>(r_i)</td>
<td>The contribution of investment in firm (i) to portfolio return</td>
</tr>
<tr>
<td>(\sigma^2_i)</td>
<td>Contribution of an investment in firm (i) to portfolio risk</td>
</tr>
<tr>
<td>(v_i)</td>
<td>Contribution of an investment in firm (i) to (L)’s expected utility</td>
</tr>
<tr>
<td>(\phi)</td>
<td>Percentage of capital allocated towards buying majority blocks</td>
</tr>
<tr>
<td>(K_i)</td>
<td>Number of shareholders, each willing to buy a single share in firm (i)</td>
</tr>
<tr>
<td>(F_i(x))</td>
<td>C.d.f. of the population of valuations of (K_i) for shares in (i)</td>
</tr>
<tr>
<td>(P_{i,max})</td>
<td>Upper bound of the support of (F_i(x))</td>
</tr>
<tr>
<td>(Q_i)</td>
<td>Demand for shares in firm (i)</td>
</tr>
</tbody>
</table>
Table 3–2: Determinants of the decision to buy majority blocks

The conditional probability of a majority block in a firm to be included in L’s portfolio is estimated using a logit specification. The independent variables are Private benefits of control as percentage of firm value (π) and Market Value of Equity (S). T-statistics are in parentheses. The odds ratio measures the relative change in the probability of a majority blocks in firm to be included in the portfolio if the independent variable is increased by one standard deviation. Panel A reports the logit estimation for the baseline scenario (E = 1.05, Max_π = 0.125, Max_S = 2, ρ = 2, σ² = 0.04, N = 50) and investment capital φ of 0.5, while Panel B reports the estimates for the baseline scenario and φ of 1. See Appendix B for more details on the numerical computations.

Panel A. Baseline Scenario, φ = 0.5

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>π</td>
<td>0.0618</td>
<td>8.1513</td>
</tr>
<tr>
<td>S</td>
<td>-0.0035</td>
<td>0.3720</td>
</tr>
<tr>
<td>Constant</td>
<td>-5.7146</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Pseudo $R^2 = 0.3724$
LR $\chi^2(2) = 655.06$
Prob > $\chi^2 = 0.0000$

Panel B. Baseline Scenario, φ = 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>π</td>
<td>0.0867</td>
<td>17.2673</td>
</tr>
<tr>
<td>S</td>
<td>-0.0033</td>
<td>0.1508</td>
</tr>
<tr>
<td>Constant</td>
<td>-7.7343</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Pseudo $R^2 = 0.5143$
LR $\chi^2(2) = 1443.59$
Prob > $\chi^2 = 0.0000$
Table 3–3: Average certainty equivalents of holding a portfolio in different scenarios

The reported Average Certainty Equivalents are for a large investor that has a total investment capital of 1 and an exponential utility function given by Assumption 7. The investor allocates a part of his total capital $\phi$ to buying majority blocks in some firms and invests the rest in the portfolio outlined in Lemma 4. The Certainty Equivalent of holding each optimal portfolio is computed as the sum of the Incremental Certainty Equivalents (ICE) of each investment in the portfolio. The ICE of each investment is given by Equation 3.16. The Average Certainty Equivalent for a scenario and a given invested capital is computed as an equally weighted average of the Certainty Equivalents of 100 optimal portfolios corresponding to 100 simulated runs of each scenario (given set of parameters) and invested capital. The parameters are the same as in the base scenario ($E = 1.05, \text{Max}_S = 2, \rho = 2, \sigma' = 0.04, N = 50$) with only $\text{Max}_\pi$ varying from 0.05 to 0.20. See Appendix B for more details on the numerical computations.

<table>
<thead>
<tr>
<th>Capital Invested in Large Blocks</th>
<th>Scenario</th>
<th>(\text{Max}_\pi = 0.05)</th>
<th>(\text{Max}_\pi = 0.10)</th>
<th>(\text{Max}_\pi = 0.125)</th>
<th>(\text{Max}_\pi = 0.15)</th>
<th>(\text{Max}_\pi = 0.20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0500</td>
<td></td>
<td>0.0029</td>
<td>0.0072</td>
<td>0.0077</td>
<td>0.0083</td>
<td>0.0127</td>
</tr>
<tr>
<td>0.1000</td>
<td></td>
<td>0.0065</td>
<td>0.0143</td>
<td>0.0171</td>
<td>0.0213</td>
<td>0.0301</td>
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<tr>
<td>0.1500</td>
<td></td>
<td>0.0108</td>
<td>0.0233</td>
<td>0.0287</td>
<td>0.0353</td>
<td>0.0491</td>
</tr>
<tr>
<td>0.2000</td>
<td></td>
<td>0.0154</td>
<td>0.0329</td>
<td>0.0411</td>
<td>0.0514</td>
<td>0.0685</td>
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<tr>
<td>0.2500</td>
<td></td>
<td>0.0194</td>
<td>0.0423</td>
<td>0.0521</td>
<td>0.0670</td>
<td>0.0909</td>
</tr>
<tr>
<td>0.3000</td>
<td></td>
<td>0.0242</td>
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<td>0.0653</td>
<td>0.0821</td>
<td>0.1100</td>
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<tr>
<td>0.3500</td>
<td></td>
<td>0.0289</td>
<td>0.0622</td>
<td>0.0781</td>
<td>0.0966</td>
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</tr>
<tr>
<td>0.4000</td>
<td></td>
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<td>0.0730</td>
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<td>0.1505</td>
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<tr>
<td>0.4500</td>
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<td>0.1027</td>
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<td>0.1712</td>
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<tr>
<td>0.5000</td>
<td></td>
<td>0.0420</td>
<td>0.0923</td>
<td>0.1155</td>
<td>0.1413</td>
<td>0.1923</td>
</tr>
<tr>
<td>0.5500</td>
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<td>0.1018</td>
<td>0.1278</td>
<td>0.1572</td>
<td>0.2125</td>
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<tr>
<td>0.6000</td>
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<td>0.1399</td>
<td>0.1719</td>
<td>0.2335</td>
</tr>
<tr>
<td>0.6500</td>
<td></td>
<td>0.0549</td>
<td>0.1208</td>
<td>0.1521</td>
<td>0.1864</td>
<td>0.2516</td>
</tr>
<tr>
<td>0.7000</td>
<td></td>
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<td>0.1303</td>
<td>0.1646</td>
<td>0.2004</td>
<td>0.2727</td>
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<tr>
<td>0.7500</td>
<td></td>
<td>0.0634</td>
<td>0.1399</td>
<td>0.1767</td>
<td>0.2143</td>
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<tr>
<td>0.8000</td>
<td></td>
<td>0.0676</td>
<td>0.1486</td>
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<td>0.3111</td>
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<tr>
<td>0.8500</td>
<td></td>
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<td>0.1579</td>
<td>0.2000</td>
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<td>0.3313</td>
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<td>0.9000</td>
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<td>0.0756</td>
<td>0.1675</td>
<td>0.2116</td>
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<td>0.3514</td>
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<tr>
<td>0.9500</td>
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<td>0.0796</td>
<td>0.1762</td>
<td>0.2232</td>
<td>0.2731</td>
<td>0.3695</td>
</tr>
<tr>
<td>1.0000</td>
<td></td>
<td>0.0840</td>
<td>0.1859</td>
<td>0.2358</td>
<td>0.2877</td>
<td>0.3893</td>
</tr>
</tbody>
</table>
Figure 3–1: A pseudo capital allocation line traced by a large investor with capital equal to 1

Average portfolio return is on the Y-axis. Portfolio variance is on the X-axis. The investor has a total available capital of 1 and $\phi$ of it is invested in majority blocks. $\phi$ ranges from 0.05 to 1. Returns are monotonically increasing in the amount of capital invested in majority blocks. As we move to the right every point on the graph is an average portfolio return-variance combination corresponding to an increasing value of capital invested. Capital invested equals 0.05 for the lower left point, and equals 1.0 for the upper right point. The average portfolio return and variance are computed as a weighted average of the respective optimal portfolios for each of a 100 runs of the baseline scenario ($E = 1.05, \text{Max}_\pi = 0.125, \text{Max}_S = 2, \rho = 2, \sigma^2 = 0.04, N = 50$). See Appendix B for more details on the numerical computations.
Figure 3–2: Portfolio returns and variance for investors with different total capital

Average portfolio return is on the Y-axis. Portfolio variance is on the X-axis. The lowest point on the curve denotes the portfolio return and variance of an investor that has a total capital of 0.05 and has invested as much as possible in controlling blocks. The subsequent points on the curve going upwards correspond to portfolios of investors with capital 0.10, 0.15,…, 0.95, 1. The average portfolio return and variance are computed as a weighted average of the respective optimal portfolios for each of a 100 runs of the baseline scenario ($E = 1.05, \text{Max}_\pi = 0.125, \text{Max}_S = 2, \rho = 2, \sigma^2 = 0.04, N = 50$). See Appendix B for more details on the numerical computations.
4.1 Institutional framework

4.1.1 The mass privatization auctions\(^{31}\)

The Bulgarian government started the process of mass privatization at the beginning of 1996. Every Bulgarian voter could acquire 25,000 vouchers for a nominal fee. These vouchers could be used to bid for shares of 1,040 firms offered in three auction rounds. Each auction round was held as a set of simultaneous (one for each firm) sealed-bid, discriminatory ("pay-your-bid") auctions with a reserve price. All unsold firm shares in one round were offered in the next round with a lower reserve price. At the same time, all vouchers submitted in unsuccessful bids were returned to the investors and could be used again in subsequent rounds.

In the first round, 968 firms were offered, 64 additional firms were offered in the second round, and another 8 firms were introduced in the third. In about 80% of the firms, more than 51% of the shares were offered for mass privatization. The remaining

\(^{31}\) See Miller and Petranov (2000) for more information about the Bulgarian Mass Privatization Scheme and the key participants in the auctions.
20% of the firms, some of the biggest and most important Bulgarian state-owned enterprises, offered 10% to 45% of their shares to the public. The remaining equity in these firms was either owned by an outside investor or was kept by the government to be sold for cash at a later date. Before the auctions started, 10% of the firm equity allocated for mass privatization was offered to employees. In most firms employees took advantage of this option, effectively reducing the supply of shares available for bidding at the auctions. Still, after the three auction rounds were over, almost all vouchers had been used and about 15% of the shares had not been bought and remained property of the State.

4.1.2 The privatization funds

The Mass Privatization Law introduced a new legal entity, the privatization fund (PF). As stated in the law, the funds were created so that individual investors could achieve diversification and to create in each firm large shareholders that would engage actively in monitoring managers or restructuring. Besides participating on their own in the auctions, individual investors could also deposit their vouchers in a PF and in exchange receive shares in the portfolio subsequently acquired by the PF at the auctions. A total of 81 privatization funds were registered. After their registration was complete, the funds had several months during which they could advertise in public media, employ distribution agents, or use other channels to market themselves to the public. After the marketing campaign was over, the PFs had collected about 75% of the total number of vouchers distributed. The other 25% remained with individuals.
The sponsors of the PFs participated with a relatively small amount of capital (a minimum of about $200,000) compared to the total equity of the funds. This separation of ownership and control generated the possibility of large agency costs between the fund founder-managers and the participating individual shareholders that deposited their vouchers in the fund. Another issue is that if the founders believed that they could be soon replaced in a control contest, they could opt for short-term gains by investing in liquid securities, then converting these to cash, and transferring the proceeds to their own accounts. As it turned out, soon after the auctions were over, the managers of most funds solidified their position by raising the fund equity capital or otherwise changing the fund charter up to the point where they had 50%, 67%, or more of the voting shares and secured complete control over the distribution of cash flows. After this demonstration of one-shot extreme agency costs, the managers changed their role in the company from agents of shareholders to absolute owners.

If most managers expected that they will be able to execute successfully the charter amendments, establish full control over their PF, and appropriate all cash flows associated with it, it can be safely assumed in the analysis below that they submitted bids for large blocks that maximize the expected utility of holding the whole fund portfolio. In the chapters below, the words Privatization Fund, institutional investor, or large investor will substitute for the founder-managers of the privatization funds, who are the only decision makers and utility maximizers regarding the fund portfolios.
4.1.3 Bidding coalitions and trading agreements

The PFs were limited by law from acquiring more than 34% of the shares of a single enterprise during the auction rounds. The 34% upper limit on blocks acquired by a single fund in a firm was restrictive and this facilitated the formation of bidding coalitions where two or more funds agree to jointly bid for a firm and acquire a 51% or larger block of shares. Conversations with managers of the PFs revealed that a common coalitional bidding scheme is as follows. A fund interested in securing majority control in a firm decides to submit a bid for 34% of the capital of the firm. Then, the fund signs a preliminary contract with another fund, where the second fund commits to acquiring an additional 17% on behalf of the first fund. It is agreed that the 17% block will be transferred to the 34% holder at a later date. Usually such contracts were agreed between the same two funds in the case of more than one firm with the two funds interchanging roles as the 34% and 17% buyer. Such repeated interactions guaranteed that the obligations under the contracts would be honored. Other coalitional agreements included two funds submitting equally sized bids as long-term strategic alliances to share control of a firm, or a 34% bidder using several other funds to buy smaller blocks on his behalf.

About nine months after the end of the last auction, all firms that were offered in the mass privatization auctions were registered on the Bulgarian Stock Exchange (BSE). This allowed the PFs to freely exchange blocks of shares acquired in the auctions and

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32 Another possible strategy available to the PFs is to bid for the maximum 34% block and hope that no other large bidder enters the auction. This strategy can be costly compared to securing majority through a coalitional bid because control over the firm could be contested. The holder of the 34% would have to spend cash and purchase more
fulfill their coalitional contract agreements. Consequently, within several months after their shares started trading on the BSE most firms had a majority holder – a single PF, a coalition, or another large investor\textsuperscript{33}.

\section*{4.2 Data\textsuperscript{34}}

\subsection*{4.2.1 Sample selection}

Names and descriptions of all variables used in this study are reported in Table 4–1. The empirical work focuses on the bids of the Bulgarian privatization funds for firms that were offered on the second round of the Bulgarian mass privatization auctions\textsuperscript{35}. A total of 820 firms had shares available for purchase on the second auction round. Table 4–2 reports the distribution of these 820 firm across different categories depending on the amount of equity offered for purchase on the second round and the type of bids submitted for each firm\textsuperscript{36}. Firms where control cannot be obtained because they have less than 50% shares on the stock exchange in order to accumulate a majority block and insulate herself from any hostile bidders.

\textsuperscript{33} Some coalitional agreements for majority blocks were executed on behalf of a third party, an investor that was interested in acquiring a privatized firm but was not registered as a privatization fund. At the BSE the majority block was transferred to this third party in exchange for cash.

\textsuperscript{34} A description of the data sources and details about the creation of the data set are included in Appendix D.

\textsuperscript{35} The bid data for the first auction round was not available, and there were much fewer firms left on the third round.

\textsuperscript{36} For the most part of the dissertation, two types of bids will be considered: small bids, which will be independent bids for less than 25% of firm equity, and large bids, which will be bids for more than 25% of firm equity or bids in majority coalitions.
of their shares available at the second round are much less likely to attract bids by privatization funds. Out of 157 firms where less than 50% of their capital was allocated for mass privatization, 93 firms or 59% receive no bids. Similarly, no PFs bid for 58% of the firms that offered more than 50% for mass privatization but had less than 50% of equity left unsold on the second auction round. These firms do not attract many large bids either, with only 3 to 10% of the firms receiving at least one large bid. Conversely, large bidders preferred to bid for firms where control is possible and especially for firms where no footholds were established on the first auction round. More than 50% of these firms receive at least one large bid, and only 30 to 42% of the firms do not receive a bid by a PF.

The purpose of the empirical part of the dissertation is to study the valuation of equity blocks revealed in bid prices. It is unavoidable in such study to drop firms that are in the original population but receive no bids and respectively no information about the value of their equity is revealed. A deletion of these firms may miss important information about the population and impose a possible selection bias. To account for this bias, the empirical regularities about the probability of a firm receiving a bid of certain size are explored using a multinomial logit model. The results in Table 4–3 demonstrate that smaller firms and firms with zero or smaller established footholds on the previous auction round are more likely to receive a large bid. The strongest result in the table is the effect of the availability of 50% or more of firm equity at the second auction round on the submission of large and small bids. Firms, where the majority of shares was still unclaimed, are much more likely to receive a large bid. On the contrary, small bidders
preferred firms where either the majority block was still held by the government or some of the shares in the majority block were already purchased on the first auction round. The results in Table 4–3 are confirmed by estimating Poisson models explaining the number of small and large bids that were submitted for a firm. The results from the Poisson model estimation are reported in Table 4–4. Smaller firms and firms where the majority of shares are still available receive a larger number of large bids and fewer small bids.

In order to concentrate only on firms where majority control is possible and where no significant stakes were acquired at the first auction round, all subsequent empirical tests will be performed on the sample of all firms that have more than 50% of their vouchers available for purchase at the second round. An additional filter imposed is that firms should have not more than 1% of their shares bought by PFs on the first round\(^\text{37}\). There are 299 firms that satisfy these conditions. The PFs submitted bids for 180 of the 299 eligible firms and the empirical analysis will concentrate on this subset of firms. Of these firms, 35 are introduced for the first time on the second round. The remaining firms were introduced on the first round, but still had most of their shares available on the second round. Table 4–5 compares these firms to the rest of the firms that receive at least one auction bid by a privatization fund, but either have less than 50% of their equity available for purchase, or more than 1% of their equity was bought by PFs on the first round.

\(^{37}\) The reason to drop from the sample 13 additional firms, where a majority is still available but there were blocks obtained by PFs on the first round, is to rule out dynamic block purchases or coalitional agreements, where one PF obtains a partial stake in a company on the first round and then on the second round either increases the stake by buying more shares or contacts another fund to do so in their account. Only a dynamic bidding and coalition formation model can fully control for such occasions. Such model
auction round. Although the differences between the variables are not statistically significant, both the means and medians suggest that the sample firms are smaller, receive more large bids, and attract fewer small bids.

Before proceeding to further econometric tests of the size of the control premium for the final sample firms, it is necessary to discuss whether the results from this sample will be representative for the population of publicly traded firms in Bulgaria. The estimation sample consists of 180 firms out of more than a thousand firms eventually listed on the Bulgarian Stock Exchange. A brief analysis of the sample selection scheme reveals that, if anything, these 180 firms have on average smaller control benefits than the whole population of publicly traded firms. First, the sample firms are all firms where the Bulgarian government offered a majority of their shares on the mass privatization auctions. The majority blocks in the largest and most profitable firms that were most attractive to potential strategic investors were kept by the government to be sold for cash to one of these investors. Second, the main part of the sample consists of firms where a majority block was left untouched by bidders on the first auction round. It is natural to expect that the sample firms have lower control benefits than the firms that did not fall into the sample because the latter firms were sold out on the previous round. These two selection biases combine for the overall conclusion that there is no evidence that the control premium estimated over the sample firms will overstate the average control premium in the Bulgarian market. It is more likely that the sample results will be negatively biased estimates for the premium in the population.

is beyond the scope of the dissertation. Furthermore, the main results remain unchanged
4.2.2 Bids by privatization funds

Out of the 81-fund universe, 72 funds submit at least one bid for a firm in the 180-firm sample. The remaining 9 funds are dropped from further analysis. A total of 615 bids are submitted by the 72 funds. As was discussed in Chapter 4.1.3, many funds submitted coalitional bids to jointly acquire a large, and in most cases, majority stake in a company. The empirical analysis of the value of control has to account for these coalitional bids because the voting power of the participants in coalitions is different than the voting power of single bidders. Appendix D briefly describes the procedure used to identify coalitional bids. The majority of the 615 bids, a total of 393, are bids submitted by coalitional partners (coalitional bids), while 222 bids are independently submitted (single bids).

The distribution of bid size, measured as percent of total firm equity for single bids is shown in Figure 4–1. More than 50%, 118 out of 222, of all single bids are for the maximum allowed 34% stake\(^ {38} \). The distribution of coalitional bids is shown on Figure 4–2. The striking difference with Figure 4–1 is that 17% bids are very common in a coalitional setting, and quite rare as a single bid choice. This is due to the frequent use by the PFs of the 34% + 17% coalitional bidding scheme described earlier. To complete the analysis of the choice of bid size, Figure 4–3 presents the sum of bid sizes of all

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\(^{38}\) A question may arise why any small bids are submitted at all. The main reason to submit a small bid is the expectation that another fund will acquire a 34% block in the firm. After the firm starts trading on the stock exchange, the minority block can be sold for cash to this large shareholder. Other small bids are submitted due to a binding budget constraint. Also, some one-shot coalitional arrangements may be misidentified as single bids.
members of a coaliotional bid in a firm. The vast majority of coalitions seek to achieve uncontested control by bidding jointly for 51% or more of firm equity.

The percent of equity offered for mass privatization will be important in the determination of the expected voting power of each block of shares. Out of the 180 firms that receive at least one bid, 100 firms offer 67%. Effectively, 60.3% of the shares in most of these firms were available for purchase, because 6.7% were offered to employees. The second largest group is the 47 firms that offer 90% for mass privatization, and effectively 81% of their capital was available on the second auction. Of the remaining 33 firms, 22 offer 70%, 2 firms offer 75%, 8 offer 80%, and one – 85%.

There is a large difference in the expected voting power of blocks of particular size in firms that offer less than 75% of their capital for mass privatization and firms that offer more than 75%. The critical value of 75% arises due to the institutional detail that 10% of the shares for mass privatization are given to employees. This results in an effective supply of shares at the auctions of 67.5% or higher for a firm with 75% or more equity offered for mass privatization. In such firms there is a possibility of two funds to own each a block close to 34%. The existence of two shareholders with one third of firm voting shares gives a lot of power to smaller shareholders and reduces the expected control value of a 34% block. In contrast, in firms that offer 67% or 70% for mass privatization only one 34% shareholder can exist. This generates high expected voting power for a 34% block, because its owner will be unconditionally the largest shareholder in the firm. Most of the empirical tests below will be performed separately for each of the
two sub-samples, the sample of 122 firms with less than 75% and the sample of 58 firms with more than 75% of their equity offered for mass privatization.

The sample of firms with less than 75% offered for mass privatization will be the main focus of the paper. First, the expected power per share of bids in these firms is strictly increasing in bid size and the tests of Hypothesis 1 will have more power. Second, there are a lot more small and large bids submitted for these firms as opposed to the group of firms with more than 75% offered for mass privatization. Third, a manager of a large PF disclosed that the big PFs were seriously considering mostly the less than 75% firms, because the other group contained either very small firms or firms in remote geographic locations.

4.2.3 Bids by Individual investors

The bids submitted by individual investors were ignored in the previous Chapters 4.2.1 and 4.2.2. The reason for that is that the price and quantity data on each individual bid is not available. There are aggregate statistics on the overall demand for each firm at the second auction round. This information in conjunction with the PF bid data can be used to infer the demand submitted by individuals. Indirect inference regarding the pricing of these bids can be obtained by comparing the submitted bids for PFs and individual demand with the after-auction allocations. This chapter will detail the results from the analysis of individual bidding at the second auction round and attempt to cast more evidence on the hypotheses in Chapter 1.
The first set of tests will involve the determinants of aggregate individual investor demand for each of the 820 firms offered on the second auction round. Aggregate individual demand is computed as the difference between total firm demand and the sum of all PF bids submitted for a firm. Table 4–6 presents a regression model of the determinants of aggregate individual demand. After comparing these results with the evidence about the determinants of PF demand in Table 4–4, it turns out that individual demand and PF demand are driven by similar factors. Individuals are more likely to bid for firms that received large interest by both large and small PF bidders. The strongest individual demand is for the 64 new firms introduced on the second auction round.

Similar to the PFs, individuals prefer smaller firms and do not bid for firms where the government kept the majority block or firms with large PF ownership from the first auction round. The only difference is that individual demand is the highest in firms where less than 50% of the shares are available on the second auction round.

There are two explanations for the relationships between individual and PF demand. The first one is that in many firms the managers organized the employees to bid their vouchers for shares in their firm in a form of pseudo Employee-Manager Buy-Outs (EMBO-s). These employee-manager coalitions were seeking to obtain control over their firms and preempt a PF takeover. At the second auction round new such coalitions were most likely to form in the newly introduced firms. The puzzling result that individuals most prefer firms with some ownership acquired at the auction round (but not PF ownership) fits also this explanation because some of the individual demand on the

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39 A similar approach was used by Hingorani, Lehn, and Makhija (1997) in their study on
second auction round may be due to further participation of employees in EMBO coalitions formed on the first auction round. Unfortunately, there is no publicly available information on these coalitions and without the individual bid pricing data they cannot be identified.

The second reason is that in an environment where control benefits are very large and a majority owner can expropriate almost all cash flows in a firm, it is optimal for small investors to seek firms where a control contest is most likely. The best-case scenario is if two unrelated PFs each get 34% of the shares, and then start competing for the shares owned by individuals in a race who is going to secure a majority first. This is consistent with the result that individuals were bidding for firms with the highest PF demand.

It would have been great to analyze the distribution of prices submitted by thousands of individuals for the firms and compare that to the prices by the PFs, but the data on prices for bids submitted by individuals is not available. As a second best solution, I will provide some circumstantial evidence about the pricing of individual bids using the fact that the data set includes the final allocation to both PFs and individuals after the end of the second auction round. This data can be used to see what percentage of individual demand is satisfied, and whether some individual bids are crowded out by higher priced PF bids. If PF submit higher priced bids than individuals, they will get a disproportionate amount of the allocated shares at the end of the auction. Under the null hypothesis all bids are submitted at the same prices. In this case, the allocation of shares

the Czech Mass Privatization auctions.
will be proportional to the bid amount as percentage of total demand of shares. A test of the hypothesis that PF bids are at higher prices than individual bids can be then constructed by comparing the final win allocations of PFs and individuals with the null allocations. By construction, the test has to focus only on firms where there is over subscription (share demand is higher than shares offered for sale). Table 4–7 reports the average null and actual allocations of large and small PF bids and individual bids. The actual PF allocations are higher than the null allocations. Given that the over subscription is moderate on average (25%) and respectively the magnitude of the crowding out of individual bids by higher-priced PF bids is small, these results show that individuals were submitting lower priced bids\(^{40}\). An even stronger result appears in Table 4–7. Large PF bids are submitted at higher prices than both small PF bids and individual bids. This result is consistent with Hypothesis 1 of the paper.

To summarize the findings of Chapter 4.2, in Bulgaria, as in most of the other transitional economies, there are few working mechanisms that enforce the interests of small shareholders. Obtaining the largest holding in a company or participating in a majority coalition is the only way for an investor to make sure that no other large shareholder can secure the private benefits associated with control. Most strategic investors are bidding for firms where control was possible to obtain and where no toeholds by other PFs were acquired at the previous round. More than 50% of the PF bids are either for the maximum allowed amount of 34% of firm shares or are submitted as a

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\(^{40}\) In unreported regressions of the abnormal share allocations of individual investors (Actual Allocations – Null Allocations) the coefficient on the number of large PF bids is negative and the only statistically significant estimate.
part of a coalitional agreement. If institutional investors choose to submit only optimally sized bids, then their strong preference for submitting large bids reveals that the control benefits of holding a large block dominate the costs of less diversification and lack of liquidity. The prevalence of large bids, given an assumption that investors are rational utility maximizers, adds support to Hypothesis 1 that substantial benefits of control exist.

Besides the large players in the Bulgarian mass privatization, individual investors also take into account the existence of large private benefits of control into their bidding behavior. They are either bidding for oversubscribed firms at the second auction round, where the possibility of a control contest was higher, or some participate in employee-manager coalitions and attempt to take control of their companies directly. The indirect inference about the bid prices submitted by individual investors reveals that they submit lower priced bids than the bids of privatization funds, especially large PF bids.
Figure 4–1: Distribution of the number of single bids by percentage of equity (bidpct2)

On the x-axis is bid size measured as percent of firm equity (bidpct2). On the y-axis is the relative frequency of bids. A total of 222 single bids were submitted for the 180 firms in the sample. The maximum allowed bid is for 34% of firm shares. 118 of the bids are for the maximum bid size.
Figure 4–2: Distribution of the number of coalitional bids by percentage of equity (bidpct2)

On the x-axis is the bid size measured as percent of firm equity (bidpct2). On the y-axis is the relative frequency of bids. A total of 393 coalitional bids are submitted for the 180 firms in the sample.
Figure 4–3: Distribution of the number of coalitional bids by the sum of percentage of equity (coalpct2)

On the x-axis is coalpct2, equal to the sum of bid sizes (bidpct2) for all members in a coalitional bid. On the y-axis is the relative frequency of such bids. The 393 coalitional bids were reduced to a total of 190 observations, keeping one observation per coalition-firm.
Table 4–1: Names and descriptions of all variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm Specific:</strong></td>
<td></td>
</tr>
<tr>
<td>firmshr</td>
<td>Total number of firm shares</td>
</tr>
<tr>
<td>masspriv</td>
<td>Percent of firm shares offered for mass privatization</td>
</tr>
<tr>
<td>reservep</td>
<td>Reserve price</td>
</tr>
<tr>
<td>MP40</td>
<td>A dummy equal to 1 if a firm has less than 50% of its shares originally allocated for mass privatization</td>
</tr>
<tr>
<td>pctoff50</td>
<td>A dummy equal to 1 if a firm has more than 50% of its shares available for sale on the second auction round</td>
</tr>
<tr>
<td>SumPFpct1</td>
<td>A variable denoting the sum of all equity blocks, measured as percent of firm equity, purchased by PFs on the first auction round</td>
</tr>
<tr>
<td>Bidtype</td>
<td>An indicator variable equal to 0 if a firm receives no bids; equal to 1 if a firm receives only large bids; equal to 2 if a firm receives only small bids; and equal to 3 if a firm receives both small and large bids</td>
</tr>
<tr>
<td>Nmedbids</td>
<td>Number of medium or larger bids submitted for a firm</td>
</tr>
<tr>
<td>A1firm</td>
<td>A dummy equal to 1 if a firm is introduced at the first auction round, and was still eligible for inclusion in the sample, and equal to 0 if the firm is first introduced at the second auction</td>
</tr>
<tr>
<td><strong>Fund Specific:</strong></td>
<td></td>
</tr>
<tr>
<td>capital2</td>
<td>Total number of vouchers bid on the second round</td>
</tr>
<tr>
<td><strong>Firm-Fund Bid Specific:</strong></td>
<td></td>
</tr>
<tr>
<td>REGION</td>
<td>Dummy equal to 1 if the privatization fund is located in the same regional center as the firm</td>
</tr>
<tr>
<td>bidpric2</td>
<td>Bid price or weighted average price if multiple bids by a single fund</td>
</tr>
<tr>
<td>Lbidpric2</td>
<td>Log(bidpric2)</td>
</tr>
<tr>
<td>bidsshr2</td>
<td>Bid size or total number of shares demanded by a fund if multiple bids</td>
</tr>
<tr>
<td>bidpct2</td>
<td>bidshr2 / firmshr</td>
</tr>
<tr>
<td>coalpct2</td>
<td>The sum of bidpct2 for all members of a bidding coalition in a firm.</td>
</tr>
<tr>
<td>choice1</td>
<td>An indicator variable equal to 0 if a PF does not submit a bid for a firm, equal to 1 if bidpct2 &lt; 25%, and equal to 2 if bidpct2 &gt; 25% or coalpct2 ≥ 50%</td>
</tr>
<tr>
<td>choice2</td>
<td>An indicator variable equal to 0 if a PF does not submit a bid for a firm, equal to 1 if coalpct2 &lt; 15%, equal to 2 if 15% ≤ coalpct2 &lt; 25%, equal to 3 if 25% ≤ coalpct2 &lt; 50%, equal to 4 if coalpct2 ≥ 50% AND bidpct2 ≤ 25%; and equal to 5 if coalpct2 ≥ 50% AND bidpct2 &gt; 25%</td>
</tr>
</tbody>
</table>
Table 4–2: Distribution of all firms available on the second auction round across different types

A total of 820 firms have shares available for purchase on the second auction round. These firms are classified into five different firm types. Firm Type 1 includes firms that have less than 50% of their shares available for mass privatization. Firm Types 2 to 4 include firms offering more than 50% of their equity for mass privatization and were introduced for the first time on the first auction round. Firm Type 2 includes all firms that have more than 50% of their shares available for mass privatization but have less than 50% of equity left for purchase on the second auction round. Firm Type 3 includes firms with more than 50% of their shares available for purchase on the second auction round but have more than 1% of their total equity purchased by PFs on the first auction round. Firm Type 4 includes firms that have more than 50% of their shares available for purchase on the second auction round and less than 1% of equity was won by PFs on the first auction round. Firm Type 5 includes all firms which are offered for the first time on the second auction round and have more than 50% of their equity allocated for mass privatization. Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions.

<table>
<thead>
<tr>
<th></th>
<th>Firm Type 1</th>
<th>Firm Type 2</th>
<th>Firm Type 3</th>
<th>Firm Type 4</th>
<th>Firm Type 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms Receiving no</td>
<td>93</td>
<td>200</td>
<td>9</td>
<td>104</td>
<td>15</td>
</tr>
<tr>
<td>bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms receiving only</td>
<td>4</td>
<td>21</td>
<td>4</td>
<td>92</td>
<td>24</td>
</tr>
<tr>
<td>large bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms receiving only</td>
<td>60</td>
<td>106</td>
<td>1</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>small bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms receiving both</td>
<td>0</td>
<td>15</td>
<td>8</td>
<td>34</td>
<td>10</td>
</tr>
<tr>
<td>small and large bids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>157</td>
<td>342</td>
<td>22</td>
<td>249</td>
<td>50</td>
</tr>
</tbody>
</table>
Table 4–3: A multinomial model of the probability of a firm to receive bids of particular type

The dependent variable is Bidtype - an indicator equal to 0 if a firm receives no bids; equal to 1 if a firm receives only large bids; equal to 2 if a firm receives only small bids; and equal to 3 if a firm receives both small and large bids. Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions. Bidtype = 0 is the comparison group. The independent variables are described in Table 4.1. The multinomial logit model is estimated using maximum likelihood. Standard errors are in parentheses.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bidtype = 1</th>
<th>Bidtype = 2</th>
<th>Bidtype = 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firmshr</td>
<td>-1.10162**</td>
<td>0.13476</td>
<td>-0.04240</td>
</tr>
<tr>
<td></td>
<td>(0.5404)</td>
<td>(0.0879)</td>
<td>(0.2652)</td>
</tr>
<tr>
<td>SumPFpct</td>
<td>-0.03874*</td>
<td>-0.00341</td>
<td>-0.01003</td>
</tr>
<tr>
<td></td>
<td>(0.0115)</td>
<td>(0.0041)</td>
<td>(0.0113)</td>
</tr>
<tr>
<td>Pct50</td>
<td>1.66406*</td>
<td>-1.30776*</td>
<td>1.82515*</td>
</tr>
<tr>
<td></td>
<td>(0.2802)</td>
<td>(0.2759)</td>
<td>(0.3983)</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.56310*</td>
<td>-0.52367*</td>
<td>-2.71272*</td>
</tr>
<tr>
<td></td>
<td>(0.2639)</td>
<td>(0.1498)</td>
<td>(0.3760)</td>
</tr>
</tbody>
</table>

Observations = 820
Pseudo R² = 0.1380
Likelihood Ratio $\chi^2 = 269.14$
Prob > $\chi^2(3) = 0.0000$

* significant at 1% level; ** significant at 5% level; *** significant at 10% level
Table 4–4: A Poisson model of determinants of the number of bids of particular type that a firm receives

The dependent variable in the model reported in the first column is the number of large bids (single bids for more than 25% of firm equity or coalitional bids for more than 50%) submitted for a firm, including firms with zero large bids. The dependent variable for the second model is the number of small bids (single bids for less than 25% of firm equity) submitted for a firm. The independent variables are described in Table 4.1. The Poisson model is estimated using maximum likelihood. Standard errors are in parentheses.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Large Bids</th>
<th>Number of Small Bids</th>
</tr>
</thead>
<tbody>
<tr>
<td>firmshr</td>
<td>-1.50921*</td>
<td>0.12752*</td>
</tr>
<tr>
<td></td>
<td>(0.3085)</td>
<td>(0.0187)</td>
</tr>
<tr>
<td>SumPFpct</td>
<td>-0.02312*</td>
<td>-0.00327</td>
</tr>
<tr>
<td></td>
<td>(0.0056)</td>
<td>(0.0025)</td>
</tr>
<tr>
<td>pctoff50</td>
<td>1.97315*</td>
<td>-0.73332*</td>
</tr>
<tr>
<td></td>
<td>(0.1530)</td>
<td>(0.1316)</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.27300*</td>
<td>-0.49294*</td>
</tr>
<tr>
<td></td>
<td>(0.1526)</td>
<td>(0.0850)</td>
</tr>
</tbody>
</table>

Observations 820 820
Pseudo R² 0.2766 0.0439
Likelihood Ratio X² 705.09 71.75
Prob >X²(3) 0.0000 0.0000

* significant at 1% level
Table 4–5: Comparison of in-sample firms with the rest of the firms that received at least one bid

The estimation sample of the paper includes 180 of the original 820 firms that were available on the second auction round. Of the remaining 640, 422 received no bids. The table compares the 180 sample firms to the 218 non-sample firms that receive at least one PF bid but are not included in the estimation. Standard deviations of the means of all variables are in parentheses. Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions.

<table>
<thead>
<tr>
<th></th>
<th>Sample Firms</th>
<th></th>
<th>Non-sample firms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Firmshr</td>
<td>146,801</td>
<td>53,456</td>
<td>397,564</td>
<td>102,847</td>
</tr>
<tr>
<td></td>
<td>(432,869)</td>
<td></td>
<td>(1,129,147)</td>
<td></td>
</tr>
<tr>
<td>Number of bids</td>
<td>3.4167</td>
<td>2</td>
<td>2.1096</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(2.7358)</td>
<td></td>
<td>(1.6856)</td>
<td></td>
</tr>
<tr>
<td>Number of large</td>
<td>2.8167</td>
<td>2</td>
<td>0.4566</td>
<td>0</td>
</tr>
<tr>
<td>bids</td>
<td>(2.5945)</td>
<td></td>
<td>(1.0801)</td>
<td></td>
</tr>
<tr>
<td>Number of small</td>
<td>0.4556</td>
<td>0</td>
<td>1.4384</td>
<td>1</td>
</tr>
<tr>
<td>bids</td>
<td>(0.7347)</td>
<td></td>
<td>(1.1923)</td>
<td></td>
</tr>
<tr>
<td>Number of obs.</td>
<td>180</td>
<td>180</td>
<td>218</td>
<td>218</td>
</tr>
</tbody>
</table>
Table 4–6: Determinants of demand by individual investors

The dependent variable in the regression is individual demand as percent of firm equity. It has been constructed as total firm demand minus the sum of all bids submitted by PFs for the firm. The description of all independent variables is in Table 4.1. The model is estimated using OLS. Standard deviations of the coefficients are in parentheses. Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firmshr</td>
<td>-0.01377**</td>
</tr>
<tr>
<td></td>
<td>(0.0065)</td>
</tr>
<tr>
<td>Number of large bids</td>
<td>0.02923*</td>
</tr>
<tr>
<td></td>
<td>(0.0041)</td>
</tr>
<tr>
<td>Number of small bids</td>
<td>0.02113*</td>
</tr>
<tr>
<td></td>
<td>(0.0069)</td>
</tr>
<tr>
<td>MP40</td>
<td>-0.06326*</td>
</tr>
<tr>
<td></td>
<td>(0.0215)</td>
</tr>
<tr>
<td>Pctoff50</td>
<td>-0.07591*</td>
</tr>
<tr>
<td></td>
<td>(0.0202)</td>
</tr>
<tr>
<td>SumPFpct1</td>
<td>-0.00145*</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
</tr>
<tr>
<td>A1firm</td>
<td>-0.28343*</td>
</tr>
<tr>
<td></td>
<td>(0.0245)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.37065*</td>
</tr>
<tr>
<td></td>
<td>(0.0300)</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs.</td>
<td>820</td>
</tr>
<tr>
<td>F-stat</td>
<td>44.78</td>
</tr>
<tr>
<td>Prob</td>
<td>0.000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.2723</td>
</tr>
</tbody>
</table>

* significant at 1% level; ** significant at 5% level; *** significant at 10% level
Table 4–7: A comparison of actual win allocations and null allocations of different bid types

The table contains mean null and actual win allocations of different bid types in different firm types. Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions. Null allocations for each bid type are computed as: 

\[ \text{(sum of shares in bids of this type) / (sum of all shares submitted)} \times \text{ (pct of firm equity offered on second round)} \]

The win allocation are computed as the sum of all share allocations to bids of particular type after the second auction round. Only firms where the number of shares demanded is greater than the number of shares available on the second auction round are used. Median values are in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Large PF null allocations</th>
<th>Large PF wins</th>
<th>Small PF null allocation</th>
<th>Small PF wins</th>
<th>Individual null allocation</th>
<th>Individual wins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms with large bids</td>
<td>0.5346 (0.5526)</td>
<td>0.5649 (0.5851)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.1139 (0.0457)</td>
<td>0.0832</td>
</tr>
<tr>
<td>N = 69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms with small bids</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.0670 (0.0670)</td>
<td>0.1028 (0.1028)</td>
<td>0.7352 (0.7352)</td>
<td>0.6995</td>
</tr>
<tr>
<td>N = 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firms with both small and large bids</td>
<td>0.4179 (0.4435)</td>
<td>0.4579 (0.5050)</td>
<td>0.0990 (0.0746)</td>
<td>0.0839 (0.0562)</td>
<td>0.0923 (0.0271)</td>
<td>0.0666</td>
</tr>
<tr>
<td>N = 36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 5

HYPOTHESES, EMPIRICAL PREDICTIONS, AND UNIVARIATE STATISTICS

5.1 Testable predictions of the hypotheses

5.1.1 Hypothesis 1

Even without maintaining a theoretical model of the relationship between block size and control power, it is a straightforward conclusion that blocks of less than several percent of firm equity will have very little voting power, while blocks of substantial size like 30% are very likely to exercise significant power. If voting power can be converted into benefits of control, then large blocks of shares will be more valuable than small blocks of shares. The auction literature has established that bid prices are monotonously increasing in bidder value. Given this result, the prices of bids for large blocks should be higher than the prices of small block bids. This implication of Hypothesis 1 provides a strict way of testing it.

A simple univariate test that can be used to document the relationship between block size and bid price is to compare the average prices bid for large blocks with the average prices bid for small blocks and test whether the difference between the two is positive. The model can be easily extended to account for additional factors that influence
bid prices. The multivariate extension is to estimate a regression equation with bid price as the dependent variable. The independent variables in the equation include firm and investor specific controls and a dummy equal to one if a block is large and zero otherwise. The coefficient on this dummy variable is an estimate of the mean difference between the prices of large and small blocks controlling for other observable factors. This difference provides an estimate of the premium that investors are willing to pay to acquire control.

The above approach to detect control benefits and estimate their size is similar to Barclay and Holderness (1989) and the rest of the block transaction studies, but instead of observing only one block trade at a particular point of time and comparing its price to the price at the stock market, in this study blocks of different size for the same firm can be simultaneously observed and their prices can be compared. Another institutional feature of the data is that a large number of bids are submitted in coalitional agreements to jointly acquire a majority block. Compared to single bidders, the participants in these coalitional bids have different expectations about the power that they will acquire if their bids are successful. As a result, the value of control and respectively the price of a bid of particular size will depend on whether a bid is coalitional or single. These features of the data and institutional framework allow for exploration of the value of control of a finer classification of bid types. A richer set of evidence regarding the existence and value of the private benefits of control can be generated.
5.1.2 Hypothesis 2a

The theoretical model in Chapter 3 showed that several factors beyond risk and expected return influence the optimal portfolio choices of a large investor when control is valuable. One of these factors is the size of a firm in terms of total value of equity. If an investor purchases a large proportion of the equity of a large firm, the investor will take a position with a substantial weight in her portfolio. A single investment with a large portfolio weight is normally associated with high diversifiable risk. An investor that seeks to acquire controlling blocks will therefore prefer to invest in smaller firms and reduce the total risk of her portfolio. Hypothesis 2a implies that the choice to invest in a significant percent of firm equity will be negatively affected by firm size41.

The existence of this relationship can be documented using first a univariate comparison of the average firm size of small and large bids. A multivariate test will involve a discrete choice model of investment decisions. The dependent variable is an indicator equal to 0 if an investor does not submit a bid for a firm, and equal to 1, 2, etc., if an investor submits a bid of a particular size range. Hypothesis 2a implies that one of

41 The derivation of this prediction implicitly assumes that firm size is uncorrelated with the amount of private benefits of control per share that can be secured by a large shareholder. Besides the direct effect on the probability of submitting large bids through the risk and budget constraint, firm size may have an indirect effect through its correlation with the control benefits. To my knowledge in the corporate governance literature there is no established functional relationship between firm size and control benefits per share. Some previous studies have claimed that large firms have larger opportunities for self-dealing. If this is the case, then the coefficient on firm size in investment choice model will understate the negative effect of firm size on the probability of submitting large blocks. If private benefits of control are easier to secure in smaller firms, then a negative coefficient of firm size may capture either risk or control effects and the empirical test of hypothesis 2a has to be interpreted with caution.
the explanatory variables in such model has to be firm size and that this variable should negatively affect the probability of submitting large bids.

5.1.3 Hypothesis 2b

Larger investors can afford to submit large bids in firms with higher market capitalization, and submit more bids. The weight of any single investment in the portfolio of an investor with a substantial investment capital is smaller than the weight of this same investment in the portfolio of a smaller investor. As a result, the unique risk born by the larger investor is smaller and this increases the likelihood of this investor to take larger (in terms of monetary value) positions. Hypothesis 2b implies that large bids will be submitted by large investors. This relationship can be detected by comparing the average investor size in small and large bids. A similar argument to the above discussion of Hypothesis 2a leads to the choice of investor capital as another explanatory variable in the probability model of bid submission. The effect of this variable on large bid submission should be positive.

5.1.4 Hypothesis 2c

The discussion in Chapter 1 posited that, given a maintained hypothesis that regional proximity can reduce investment uncertainty and increase control benefits, if control benefits are valuable, the effect of regional proximity on the probability of submitting large bids should be positive. This suggests that a measure of the geographical
distance between an investor and a firm has to be included as one of the factors influencing the decision to bid for a privatized firm.

5.2 Univariate tests of the hypotheses

The remainder of this chapter will report results from several univariate summary statistics as exploratory tests of the hypotheses developed above. The tests involve the computation of the average prices, firm size and PF capital of the small bid observations in the data and a comparison of the results with the average prices, firm size and PF capital of large bid observations.

Table 5–1 contains the results of these simple mean comparisons. Focusing on the sub-sample of firms with less than 75% of their capital of mass privatization, indeed large bids are submitted at higher prices. The premium for control using raw prices is 26%. Large bidders also pay a 67% higher premium over the reserve price than small bidders. The summary statistics in Table 5–1 are also consistent with Hypotheses 2a and 2b. The average firm size of a large bid is three times smaller than the average firm size of a small bid, while large bidders have 58% more capital (the difference of the medians is much larger). Consistent with the claim that small bids can have a high control value per share in firms with more than 75% of their capital offered, the prices of these bids are higher. In general these firms are very small and the differences between the average firm size for large and small bids are small. Large bids were submitted by larger PFs. The results of the tests have to be interpreted with caution because the standard deviations of all mean estimates are very large and none of the differences in means are statistically
significant. One of the reasons for this lack of statistical significance of the mean comparisons is the high heterogeneity in sample firm quality.

Conclusions about the difference in prices using unconditional averages may be flawed because, as the discussion in the previous sub-chapter indicated, large bids may be submitted for different types of firms than small bids. Table 5–2 separates the sample of firms into three categories, firms receiving only small bids, firms receiving only large bids, and firms receiving both small and large bids. The control premium using average prices of small and large bids submitted for each firm type does not substantially differ. Using only firms receiving both small and large bids, large bids have on average 26% higher prices, and pay a 55% higher premium over the reserve price. For the group of firms in Panel B, the price difference of bids is negligible, with large bids having a small premium.

Another comparison of the prices of large and small bids is to compute the premium of large bids over small bids for each firm that receives both types of bids and then compute the average firm level premium across all such firms. The computation of the price difference between large and small bids for each firm alleviates the effect for firm specific unobservables and affords a cleaner measure of the control premium. The average premium of the 37 firms with less than 75% offered for mass privatization is 32.3% (median 18.3%)\(^4\). A non-parametric exploration reveals that in 28 of the 37 firms the highest-price bid is large, while in only five firms the highest-price bid is small (in 4

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\(^4\) There are only seven firms with more than 75% for mass privatization that receive both small and large bids. The premium computed for these firms is –116% (median 2.7%).
firms the highest bids are one large and one small bids submitted at the same price\(^{43}\).
The percentage of small bids among all bids submitted for the 33 firms without ties is 27%, while they are the maximum bid in only 15% of the firms.

Another measure of the control premium that also accounts for firm specific unobservables is to compare the prices of different sized bids that are part of the same coalitional agreement to acquire a majority block in a firm. Results from this analysis are reported in Table 5–3. An empirical fact that biases the analysis against finding significant results is that most coalitional bids are submitted at the same price. This is due to the reciprocal arrangements where two funds exchange roles in being the dominant and supporting member of a coalition across different firms. These agreements increase the bargaining power of the minority participants in bidding coalitions, because they have the opportunity to punish deviation from the original contract using their superior position in another firm. Nevertheless, the mean price difference between large and small coalitional bids is 8.5% when all bids are used and 17% when only bids at different prices are used. In comparison, coalitional bids when two funds submit same-sized bids have negligible price differences.

To summarize the findings of the exploratory univariate analysis, large bids have a moderately sized price premium of between 17 and 32% over small bids; they are submitted for significantly smaller firms, and by PFs with more capital. The summary statistics are consistent with the hypotheses, but the control premium is not very large.

\(^{43}\) These may be unidentified coalitional agreements.
The reasons for that are the discussed above selection bias and the inherent lack of other controls in the univariate mean comparisons. Chapter 6 will utilize an econometric model that solves the selection bias problems and computes conditional expected prices of large and small equity blocks in a multivariate setting.
Table 5–1: Summary statistics of different sized bids

Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions. Bidpric2 is in vouchers. Premium is computed as (Bidpric2-reservep)/reservep. Capital2 is nominated in thousand vouchers.

Panel A. Masspriv < 75%

<table>
<thead>
<tr>
<th></th>
<th>Mean Values</th>
<th>Median Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Bids</td>
<td>Large Bids</td>
</tr>
<tr>
<td>Bidpric2</td>
<td>609.85</td>
<td>769.55</td>
</tr>
<tr>
<td>Premium</td>
<td>0.467</td>
<td>1.132</td>
</tr>
<tr>
<td>Firmshr</td>
<td>330,819</td>
<td>121,297</td>
</tr>
<tr>
<td>Capital2</td>
<td>374,139</td>
<td>588,938</td>
</tr>
</tbody>
</table>

Panel B. Masspriv > 75%

<table>
<thead>
<tr>
<th></th>
<th>Mean Values</th>
<th>Median Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Bids</td>
<td>Large Bids</td>
</tr>
<tr>
<td>Bidpric2</td>
<td>1364.98</td>
<td>1000.36</td>
</tr>
<tr>
<td>Premium</td>
<td>2.158</td>
<td>1.294</td>
</tr>
<tr>
<td>Firmshr</td>
<td>37,298</td>
<td>50,190</td>
</tr>
<tr>
<td>Capital2</td>
<td>272,325</td>
<td>431,316</td>
</tr>
</tbody>
</table>
Table 5–2: Summary statistics of bid prices for different types of firms

Small PF bids are single bids for less than 25% of firm equity; large bids are bids for more than 25% of firm equity or bids participating in majority coalitions. Prices are in vouchers. Premium is computed as \((\text{Bidprice} - \text{reserveprice}) / \text{reserveprice}\). Medians values are in parentheses.

Panel A. Masspriv < 75%

<table>
<thead>
<tr>
<th></th>
<th>Prices</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Bids</td>
<td>Large Bids</td>
</tr>
<tr>
<td>Firms with small bids</td>
<td>572.06</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>(505)</td>
<td>(n.a.)</td>
</tr>
<tr>
<td>Firms with large bids</td>
<td>n.a.</td>
<td>758.37</td>
</tr>
<tr>
<td></td>
<td>(587)</td>
<td>(n.a.)</td>
</tr>
<tr>
<td>Firms with both</td>
<td>623.52</td>
<td>788.25</td>
</tr>
<tr>
<td></td>
<td>(503)</td>
<td>(672)</td>
</tr>
</tbody>
</table>

Panel B. Masspriv > 75%

<table>
<thead>
<tr>
<th></th>
<th>Prices</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Bids</td>
<td>Large Bids</td>
</tr>
<tr>
<td>Firms with small bids</td>
<td>1190.25</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>(456)</td>
<td>(n.a.)</td>
</tr>
<tr>
<td>Firms with large bids</td>
<td>n.a.</td>
<td>902.62</td>
</tr>
<tr>
<td></td>
<td>(593)</td>
<td>(n.a.)</td>
</tr>
<tr>
<td>Firms with both</td>
<td>1504.76</td>
<td>1637.82</td>
</tr>
<tr>
<td></td>
<td>(902)</td>
<td>(1091)</td>
</tr>
</tbody>
</table>
Table 5–3: Prices of two-fund coalitional bids

There are 190 coalitional agreements that generated 393 total coalitional bids for the 180 firms in the sample. 13 of the 190 agreements are between 3 funds and are dropped from the analysis. In 13 of the remaining 177 coalitions, both funds submit bids of equal sizes. The rest are coalitions where one fund has a dominant role by submitting a larger sized bid. The most common example of these agreements is a 34% + 17% scheme. The premium for different-sized coalitional bids is defined as (price of larger-sized bid – price of smaller-sized bid) / (price of smaller-sized bid). The majority of coalitional bids are at the same price due to reciprocal agreements between the two funds.

<table>
<thead>
<tr>
<th># obs. where premium &lt; 0</th>
<th>16</th>
<th>n.a.</th>
</tr>
</thead>
<tbody>
<tr>
<td># obs. where premium = 0</td>
<td>86</td>
<td>10</td>
</tr>
<tr>
<td># obs. where premium &gt; 0</td>
<td>62</td>
<td>3</td>
</tr>
<tr>
<td>Mean premium for all obs.</td>
<td>0.0840</td>
<td>0.009</td>
</tr>
<tr>
<td>Median premium for all obs.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean premium if premium ≠ 0</td>
<td>0.1767</td>
<td>0.0371</td>
</tr>
<tr>
<td>Median premium if premium ≠ 0</td>
<td>0.0513</td>
<td>0.0151</td>
</tr>
</tbody>
</table>
Chapter 6  
ECONOMETRIC MODEL AND RESULTS

6.1 Econometric model

The previous chapter identified the predictions of the hypotheses and translated these predictions into statistical tests of the signs of certain estimated coefficients and into evaluation of conditional mean differences. Afterwards these predictions were tested using univariate summary statistics methods. This chapter proposes a more advanced econometric model for the unbiased estimation of these coefficients and conditional means.

In order to provide evidence on the central question of the empirical part of the dissertation, whether private benefits of control exist and to estimate their size, I have to document whether the difference between the prices submitted for large blocks of shares and the prices submitted for small blocks of shares is positive and significantly different than zero. At first glance, an OLS model of bid prices regressed on firm and fund controls and dummies for different bid sizes will provide the required evidence. However, investors will submit small or large sized bids only when this action is optimal among all other alternatives. A comparison of bid prices using a classic regression model ignores the underlying decision process of the privatization funds and suffers from the selection bias discussed in Chapter 1. Because of this selection bias the difference between the
prices submitted for large and small bids will understate the magnitude of the private benefits of control. Furthermore, three hypotheses were developed in Chapter 5 that predict what are the determinants of the investment decisions of the institutions in this study. These hypotheses can be tested using a probability model of bid size submission as a function of variables that proxy for fund capital, firm size, and geographic proximity between a fund and a firm.

Both the selection bias of an OLS bid price model and the empirical test of Hypotheses 2a, 2b, and 2c can be addressed using a methodology developed in Lee (1983). The method involves a two-stage estimator. In the first stage every privatization fund chooses for each of the 180 firms in the sample between several mutually exclusive alternatives. At a minimum, these alternatives can be: (0) not to bid; (1) to submit a bid for a small block; and (2) to submit a bid for a large block. Other alternatives, like the submission of coalitional bids can be easily added to the choice set of an investor. When choosing among the alternatives, every PF will pick the one alternative that offers her the highest utility. The first stage selection process is then estimated as a multinomial logit model. At least one of the right-hand-side variables in the logit model has to be uncorrelated with bid price. This variable will act as an instrument in the identification of the first-stage selection model.

The second-stage estimation involves running for each of the positive bid decisions of the investors a separate OLS regression of the form:

\[ y_{ij} = \beta_j X_{ij} + \varphi_j \lambda_{ij} + \epsilon_{ij} \]  (6.1)
Where the \(i\) subscript denotes observation and the \(j\) subscript denotes the different choice at the first stage. The dependent variable \(y_{ij}\) is bid price, \(X_{ij}\) is a vector of firm specific and fund specific regressors, and \(\lambda_{ij}\) is a selection correction term that is a function of the predicted values from the multinomial logit model estimated at the first stage. The purpose of this selection term is to control for the endogenous decision of the funds to submit a bid of particular size for the firms in the sample.

Last, the estimated coefficients and the means of the right-hand-side variables are used to compute the conditional expected prices for bids in each of the investment choice categories. The value of these conditional expected prices can be then used to compute an estimate of the premium for control that is free of selection bias. The two-stage methodology is described in more detail in Appendix E.

### 6.2 Model estimation

#### 6.2.1 First-stage selection equation

The first decision that has to be made is to determine the set of alternatives faced by the PFs in their investment decision for each firm. The model in this chapter will have three investment choices – no bid, small bids, and large bids. The model will be extended to six investment choices in the Chapter 6.4.
Given the discussion in Chapter 5, three instruments are included in the first stage investment selection equation. The first variable is the total number of firm shares \((\text{firmshr})\). The shares of all privatized firms have the same par value (1,000 Bulgarian Levs). The number of shares is therefore equivalent to the firm book value of equity. Theoretical foundation for the inclusion of this variable is provided by Hypothesis 2a. The second variable is the number of vouchers owned by each PF at the beginning of the second auction round \((\text{capital2})\). This variable is included as a direct test of Hypothesis 2b. The third instrument is a dummy \(\text{REGION}\) (equal to 1 if a fund is located in the same regional center as a firm). The choice of this dummy is motivated by Hypothesis 2c. The last variable in the multinomial logit equation is reserve price \((\text{reservep})\). It is included to control for the fact that only bid prices above the reserve price for each firm can be submitted.

As was discussed in Chapter 4, there are fundamental differences in control values between, on one hand, 67% and 70% firms, and on the other hand, 75%, 85%, and 90% firms. These differences in the control premium imply that the selection model has to be estimated separately for these two groups of firms. Accordingly, control premiums for different-sized blocks have to be computed separately.

### 6.2.2 Second-stage regressions

The second stage of the model consists of the estimation of two separate OLS regressions. The dependent variable bid price \((\text{Bidpric2})\) in the second-stage regression
analysis takes only positive values. Lee (1984) gives a detailed explanation why in this case a log transformation of the dependent variable is required.

Four independent variables are used. The first one is reserve price \((\text{reservep})\). This variable controls for the fact that the PFs have to submit a price equal to or larger than the reserve price announced by the government\(^{44}\). The second variable is a dummy equal to one if the firm was introduced for the first time on the first auction \((A1\text{firm})\). This variable measures the effect of negative information about a firm if a firm was introduced on the previous auction round and attracted no interest from any privatization funds on that round. Its coefficient is expected to be negative. The third variable is the number of serious bids (bids for more than 15% of the firm shares) submitted for a firm \((Nmedbids)\). This variable is a proxy for the level of competition in an auction and for unobservable firm quality that generates high demand from large bidders\(^{45}\). The last variable is the selection term \((\lambda)\), created using the estimates of the first-stage selection equation. Details about its computation are included in Appendix E.

\(^{44}\) A set of regressions are estimated using the \(\log(1+\text{premium})=\log(\text{Bidpric2/reservep})\) as the dependent variable. Results were very similar. The estimates from these regressions are slightly more difficult to use when computing expected mean prices for blocks of different size. That is why they are dropped in favor of a model with raw bid prices as dependent variable and reserve price as one of the controls. Moreover, the Bulgarian government might have revealed additional information about each firm in its choice for reserve price.

\(^{45}\) Using the number of all bids by PFs or the ratio of shares demanded to shares offered as alternative proxies for firm quality and auction competition does not substantially change the results.
6.3 Results

6.3.1 Results about the investment choice hypotheses

*Table 6–1* reports the results from the estimation of the first-stage investment choice model. The model is first estimated using the whole 180-firm sample. As a robustness check the model is also estimated using a restricted sample of only firms that receive both small and large firms. This alleviates a potential problem if firms that receive only large bids are systematically different than firms that receive only small firms and these differences are not controlled by the independent variables. Hypothesis 2a is consistent with the evidence in the table. The coefficient on firm value of equity \((firmshr)\) is negative and statistically significant for large blocks \((choice1 = 2)\) in the model for firms with less than 75% offered for mass privatization, and positive and statistically significant for small blocks \((choice1 = 1)\). Based on the coefficients, a one-standard-deviation increase in firm equity decreases the odds of submitting a large bid by 86% in favor of submitting a small bid. The difference in the effect of firm size on the probability of small and large bid submission is statistically significant based on a Wald test.

If we compare the odds-ratios for submitting a bid versus not submitting bid, the value of equity of a firm positively affects the likelihood of submitting small bids. A one-standard-deviation increase in firm equity increases the odds of submitting a small bid by 13% compared to submitting no bid, and decreases the odds of large bids by 64%. The
finding that small bids are more likely to be submitted than large bids in large firms offers additional indirect support of Hypothesis 2a. It confirms the idea that if in large firms it is less likely for large and especially majority blocks to be assembled, then a small block has a higher expected control power and respectively a higher probability to be submitted. The conclusions regarding Hypothesis 2a are robust to the estimation sample. This is true for most of the other coefficients in both the first and second-stage estimation. For brevity only the coefficients estimated using the whole sample will be discussed.

Hypothesis 2b is strongly supported by the data. Large investors are more likely to submit larger bids. A one standard deviation increase in $\text{capital}^2$ increases the odds of submitting a large bid by 42% as opposed to submitting a small bid. This result confirms the conjecture that only large investors in a market where control is valuable can afford to construct a portfolio of large and possibly controlling blocks without paying the cost of bearing high diversifiable risk.

Last, Hypothesis 2c is also consistent with the data. Regional proximity dramatically increases the likelihood of submitting both large and small bids. The effect of regional proximity is almost the same for large and small bid submission. Given the coefficients in Table 6–1 changing the dummy $\text{REGION}$ from 0 to 1 increases the odds of submitting a small bid by 151% and the odds for submitting a large bid by 117% versus not bidding.
6.3.2 An estimate of the private benefits of control

The estimation output from the second-stage regression equations is reported in Table 6–2. All control variables have the expected signs. One finding that has to be stressed is that the coefficient of \( \lambda \) is negative in the regression for large bids and positive in the regression for small bids. This finding supports the suggestion expressed in the Introduction that the possibility of selection bias will in general understate the value of the private benefits of control. Both regressions have a respectable explanatory power, which gives confidence in the estimates of the control benefits below.

The estimation results in Table 6–2 cannot readily answer the central question of this study: do benefits of control exist. The answer to this question and a calculation of the value of control require the computation of the expected values for bid prices \( \text{Lbidprice}^2 \) corresponding to bids for different sized blocks. The expected bid prices are evaluated at the means of the right-hand side continuous variables and for each value of the dummy \( A_{1\text{firm}} \). The results from this conditional mean computation for each of the two investment choices are included in Table 6–3. After correcting for the selection and endogeneity biases, I find that institutions submit higher prices for large blocks of shares compared with small blocks of shares. The estimated value of control is enormous. The prices of large blocks are about ten times higher that the prices of small blocks. Results are robust to computing the model over the much smaller sub-sample of firms receiving both small and large blocks. The only change is the explosive behavior of expected prices.

---

\[ \text{Lbidprice}^2 \]

See Lee (1984) for a similar approach and an explanation why the correction term \( \lambda \) should not be used in the computations of the expected value of the dependent variables.
in the restricted model for firms with more than 75% for mass privatization. This is due
to the small sample size (10 small and 23 large-bid observations), which is not sufficient
to estimate precisely the parameters of the model. The instability of the model to small
sample sizes will be manifested again in the extended model in the next sub-

6.4 Results from an extended model

The data allows for the original scheme of no bid, small bid, and large bid to be
extended further to account for the possibility of a coalition to acquire uncontested
majority control in a firm. Because in most of the coalitional bids the members
participate with different sized bids, the coalitional choice can be separated into two
categories: submit a small, supporting bid, or submit a large, dominant bid in the
coalition. These choices reflect the fact that in most cases one fund is seeking control
over a firm and asks other partners to acquire on his behalf the complementary 17%
required for a majority block to be secured. Also, the original small bid category can be
further divided into small and medium sized bids.

The final set of possible choices is extended to six alternatives: 0) no bid; 1) submit a small single bid; 2) submit a medium single bid; 3) submit a large bid; 4) submit a small bid as a part of a coalition seeking to acquire jointly 51% or more of firm capital; and 5) submit a large bid as a part of a coalition seeking to acquire jointly 51% or more of firm capital. The following cutout values for the alternatives are chosen47. Small bids

---

47 Due to the strong clustering of bids around 17% and 34% the choice of actual cutout values does not have a large effect on the results.
are bids with size less than 15% of firm equity. Medium bids are bids between 15% and 25% of firm equity. Large bids are single bids for 25% to 34% of firm equity, or coalitional bids for a total of less than 50%\textsuperscript{48}. Small coalitional bids are bids for less than 25% of firm equity, which are a part of a coalition seeking 50% or more. Large coalitional bids are bids for more than 25% of firm equity, which are a part of a majority seeking coalition.

The first-stage multinomial logit estimation results of the extended model are reported in Table 6–4. The model is estimated only over the original 180 firm sample because the sub-sample of firms with both small and large bids leaves some investment choices with a very small number of observations. The results from the original model are enriched with several new findings. Regarding Hypothesis 2a, larger investors are not only less likely to submit smaller bids, but also they are much more likely to participate in majority coalitions. One explanation for this result is that the large PFs have more to gain by forming coalitions with similar-sized PFs. The possibilities for tit-for-tat coalitional bidding are much higher when the two funds are large, because they can enforce the coalitions in more firms. Also a large fund can generate more competition if it is left outside the coalitional circle.

The effect of firm size is similar to the one in the original model and consistent with Hypothesis 2b. Small and medium bids are submitted for larger firms, while the

\textsuperscript{48} The number of such bids across all firms is less than 15. That is why they are grouped together with single large bids - the closest bid type corresponding to their expected control power.
three large bid choices are more likely to be tendered for smaller firms. The negative effect of firm size is stronger for coalitional bids.

One interesting finding in the test of Hypothesis 2c is that regional proximity has the weakest effect on the likelihood of submitting small coalitional bids. This confirms the fact that the large member of a coalitional bid is the party interested in achieving control, while the smaller member is usually participating in exchange for receiving a similar favor in another firm. The strongest effect of regional proximity is on the probability of submitting a small independent bid.

The next step after completing the first-stage estimation of the extended model is to compute conditional expected prices for each of the five different investment choices. The results are in Table 6–5. Besides reinforcing the findings in Table 6–3 that a large control premium exists, the extended choice set allows for further evidence on the relative pricing of bids that have different expected voting power. The model also allows measuring the value of forming a majority coalition. Coalitions expect to earn an unconditional majority in a firm and that is why, keeping bid size constant, they submit higher prices than single bidders. The average price of shares in coalitional majority bids, computed as the weighted average of the large and small coalitional bid prices, is about 45% higher than the average price of shares in combinations of one large single bid and one medium single bid.

The estimated conditional prices for the sample of firms with more than 75% of their shares available for mass privatization are quite extreme. This is most likely due to the fact that there are only ten small and eight medium single bids submitted for these
firms and the respective coefficients for these investment choices are very noisily
estimated. This is another illustration of the suggestion that the Lee (1983) selection
model is not stable if the sample size is small. The bootstrapped p-values correctly detect
the high instability of the coefficients and are not statistically significant.

49 An alternative explanation of the high prices for medium single bids is related to the
previous analysis that in such firms the possibility of two large shareholders to appear
simultaneously after the auction gives a disproportionate bidding power to a medium
shareholder in the firm. The power per share of such a shareholder exceeds the power per
share of the large competitors. The expected gains from such disproportionate power may
be reflected in the expected bid price for medium bids.
Table 6–1: First-stage multinomial logit estimation results

The dependent variable is \( \text{choice1} \): equal to 0 if a PF does not submit a bid for a firm, equal to 1 if the bids is single and \( \text{bidpct2} \leq 25\% \), and equal to 2 if \( \text{bidpct2} > 25\% \) or \( \text{coalpct2} \geq 50\% \). \( \text{Choice1} = 0 \) (no bid) is the comparison group. The independent variables are described in Table 4.1. The multinomial logit model is estimated using maximum likelihood. Standard errors for each coefficient are in parentheses. The multinomial logit model is estimated over two samples. The first sample contains all 180 firms in the original sample (122 firms with \( \text{masspriv} < 75\% \) and 58 firms with \( \text{masspriv} \geq 75\% \)). The second sample contains only firms that receive both small and large bids (37 firms with \( \text{masspriv} < 75\% \) and 7 firms with \( \text{masspriv} \geq 75\% \)). The odds-ratio computes the changes in the probability of submitting a large bid versus a small bid after increasing the continuous variables by one standard deviation, or changing the dummy from 0 to 1. The Wald test is a test of the restriction that the coefficients on each independent variable are equal across the equation for small bids and the equation for large bids.

Panel A. Masspriv < 75%

<table>
<thead>
<tr>
<th>Variable</th>
<th>All firms</th>
<th>Firms with small and large bids</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choice1 = 1</td>
<td>Choice1 = 2</td>
<td></td>
</tr>
<tr>
<td>capital2</td>
<td>Coefficient</td>
<td>0.00111*</td>
<td>0.00220*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0003)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>Odds-ratio</td>
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<td>1.4192</td>
<td>0.0009</td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>firmshr</td>
<td>Coefficient</td>
<td>0.00025***</td>
<td>-0.00096*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0001)</td>
<td>(0.0003)</td>
</tr>
<tr>
<td>Odds-ratio</td>
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<td>0.5379</td>
<td>0.0014</td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGION</td>
<td>Coefficient</td>
<td>0.92132*</td>
<td>0.77193</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.3368)</td>
<td>(0.6129)</td>
</tr>
<tr>
<td>Odds-ratio</td>
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<td>0.6853</td>
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<td>Wald test p-value</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Reservp</td>
<td>Coefficient</td>
<td>-0.00054</td>
<td>-0.001744*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0009)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>Constant</td>
<td>Coefficient</td>
<td>-5.14216*</td>
<td>-3.27240*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.4389)</td>
<td>(0.1991)</td>
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<table>
<thead>
<tr>
<th></th>
<th>Choice1 = 1</th>
<th>Choice1 = 2</th>
<th>Choice1 = 1</th>
<th>Choice1 = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>0.00104*</td>
<td>0.00192*</td>
<td>0.00005</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0003)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td>1.3564</td>
<td>0.0282</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservp</td>
<td>Coefficient</td>
<td>-0.00096*</td>
<td>-0.00096</td>
<td>-0.00096</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>(0.0013)</td>
<td>(0.0004)</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>Constant</td>
<td>Coefficient</td>
<td>-3.76631*</td>
<td>-3.76631*</td>
<td>-3.76631*</td>
</tr>
<tr>
<td></td>
<td>(0.5454)</td>
<td>(0.5454)</td>
<td>(0.5454)</td>
<td>(0.3459)</td>
</tr>
</tbody>
</table>

Observations = 8784  Observations = 2072
Pseudo R² = 0.0968    Pseudo R² = 0.0715
Likelihood Ratio \( \chi^2 = 347.68 \)  Likelihood Ratio \( \chi^2 = 99.15 \)
Prob >\( \chi^2(20) = 0.0000 \)  Prob >\( \chi^2(20) = 0.0000 \)

*significant at 1% level; **significant at 5% level; *** significant at 10% level

(cont. on next page)
Table 6–1 (cont.)

Panel B. Masspriv ≥ 75%

<table>
<thead>
<tr>
<th>Variable</th>
<th>All firms</th>
<th>Firms with small and large bids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choice1 = 1</td>
<td>Choice1 = 2</td>
</tr>
<tr>
<td>capital2</td>
<td>Coefficient</td>
<td>0.00035</td>
</tr>
<tr>
<td></td>
<td>(0.0007)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td>1.3866</td>
<td>0.1490</td>
</tr>
<tr>
<td>Wald test p-value</td>
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<td></td>
</tr>
<tr>
<td>firmshr</td>
<td>Coefficient</td>
<td>-0.00692</td>
</tr>
<tr>
<td></td>
<td>(0.0059)</td>
<td>(0.0011)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td>1.5844</td>
<td>0.2277</td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REGION</td>
<td>Coefficient</td>
<td>2.48296*</td>
</tr>
<tr>
<td></td>
<td>(0.4114)</td>
<td>(0.2298)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td>0.2609</td>
<td>0.0120</td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservp</td>
<td>Coefficient</td>
<td>-0.00042</td>
</tr>
<tr>
<td></td>
<td>(0.0012)</td>
<td>(0.0014)</td>
</tr>
<tr>
<td>Constant</td>
<td>Coefficient</td>
<td>-5.49028*</td>
</tr>
<tr>
<td></td>
<td>(0.6852)</td>
<td>(0.6303)</td>
</tr>
</tbody>
</table>

Observations =4176 Observations =392
Pseudo R² =0.0588 Pseudo R² =0.0919
Likelihood Ratio \( \chi^2 = 98.19 \) Likelihood Ratio \( \chi^2 = 24.55 \)
Prob >\( \chi^2(20) = 0.0000 \) Prob >\( \chi^2(20) = 0.0019 \)

*significant at 1% level; **significant at 5% level; *** significant at 10% level
Table 6–2: Second-stage regression results

The dependent variable is $Lbidpric2$. In each panel two regressions (one for each investment choice) are estimated. The regressions are estimated over two samples. The first sample contains all 180 firms in the original sample (122 firms with $masspriv<75\%$ and 58 firms with $masspriv\geq75\%$). The second sample contains only firms that receive both small and large bids (37 firms with $masspriv<75\%$ and 7 firms with $masspriv\geq75\%$. Lambda is the selection correction term. Details about its formulation are in Appendix E. The rest of the independent variables are described in Table 4.1. Lee (1983) t-stats are in parentheses.

Panel A. Masspriv < 75%

<table>
<thead>
<tr>
<th>Variable</th>
<th>All firms</th>
<th>Firms with small and large bids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choice 1 = 1</td>
<td>Choice 1 = 2</td>
</tr>
<tr>
<td>reservp</td>
<td>0.0020*</td>
<td>0.0021*</td>
</tr>
<tr>
<td></td>
<td>(3.46)</td>
<td>(10.66)</td>
</tr>
<tr>
<td>Nmedbids</td>
<td>0.0384***</td>
<td>0.0364*</td>
</tr>
<tr>
<td></td>
<td>(1.35)</td>
<td>(3.67)</td>
</tr>
<tr>
<td>A1firm</td>
<td>-0.2328</td>
<td>-0.2322*</td>
</tr>
<tr>
<td></td>
<td>(-1.22)</td>
<td>(-3.65)</td>
</tr>
<tr>
<td>lambda</td>
<td>0.7278*</td>
<td>-0.2226*</td>
</tr>
<tr>
<td></td>
<td>(2.97)</td>
<td>(-4.05)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.4959*</td>
<td>6.0235*</td>
</tr>
<tr>
<td></td>
<td>(6.03)</td>
<td>(36.16)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.5003</td>
<td>0.3857</td>
</tr>
<tr>
<td>Obs.</td>
<td>64</td>
<td>334</td>
</tr>
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</table>

Panel B. Masspriv ≥ 75%

<table>
<thead>
<tr>
<th>Variable</th>
<th>All firms</th>
<th>Firms with small and large bids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choice 1 = 1</td>
<td>Choice 1 = 2</td>
</tr>
<tr>
<td>reservp</td>
<td>0.0031</td>
<td>0.0014*</td>
</tr>
<tr>
<td></td>
<td>(1.35)</td>
<td>(6.58)</td>
</tr>
<tr>
<td>Nmedbids</td>
<td>0.1217***</td>
<td>0.0408</td>
</tr>
<tr>
<td></td>
<td>(1.83)</td>
<td>(1.63)</td>
</tr>
<tr>
<td>A1firm</td>
<td>0.4329</td>
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<td></td>
<td>(0.52)</td>
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<td>lambda</td>
<td>0.2256</td>
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<td></td>
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<td>(-0.84)</td>
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<tr>
<td>Constant</td>
<td>3.9656*</td>
<td>6.0728*</td>
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<tr>
<td></td>
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<td>$R^2$</td>
<td>0.4127</td>
<td>0.3857</td>
</tr>
<tr>
<td>Obs.</td>
<td>18</td>
<td>173</td>
</tr>
</tbody>
</table>

* significant at 1% level; ** significant at 5% level; *** significant at 10% level
Table 6–3: Conditional expected bid prices

The conditional mean bid prices for each bid choice are evaluated at the means of the continuous independent variables \( \text{reservp} \) and \( \text{Nmedbids} \) using the parameter vector estimates in Table 6.2. The means for the first two columns in each table are computed at \( A_{1\text{firm}} = 0 \), the means in the second two columns at \( A_{1\text{firm}} = 1 \). Booststrapped p-values for \( H_0: E[\text{bidprice of large blocks}] - E[\text{bidprice of small blocks}] \leq 0 \) are in parenthesis. Details about the bootstrapping are included in the last paragraph of Appendix E. Due to lack of sufficient number of observations, the bootstrapping methodology breaks in 24% of the runs in the last model in Panel B.

Panel A. Masspriv < 75%

<table>
<thead>
<tr>
<th></th>
<th>Round 2 Firms (( A_{1\text{firm}} = 0 ))</th>
<th>Round 1 Firms (( A_{1\text{firm}} = 1 ))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log Value</td>
<td>Voucher Equivalent</td>
</tr>
<tr>
<td></td>
<td>All firms (122 firms)</td>
<td></td>
</tr>
<tr>
<td>Large blocks, 334 bids</td>
<td>7.0787 (0.006)</td>
<td>1186</td>
</tr>
<tr>
<td>Small blocks, 64 bids</td>
<td>4.5225 (n.a.)</td>
<td>92</td>
</tr>
<tr>
<td>Only firms receiving small and large bids (37 firms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large blocks, 125 bids</td>
<td>6.8800 (0.039)</td>
<td>973</td>
</tr>
<tr>
<td>Small blocks, 47 bids</td>
<td>3.9934 (n.a.)</td>
<td>54</td>
</tr>
</tbody>
</table>

Panel B. Masspriv ≥ 75%

<table>
<thead>
<tr>
<th></th>
<th>Round 2 Firms (( A_{1\text{firm}} = 0 ))</th>
<th>Round 1 Firms (( A_{1\text{firm}} = 1 ))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log Value</td>
<td>Voucher Equivalent</td>
</tr>
<tr>
<td></td>
<td>All firms (58 firms)</td>
<td></td>
</tr>
<tr>
<td>Large blocks, 173 bids</td>
<td>6.9667 (0.233)</td>
<td>1,061</td>
</tr>
<tr>
<td>Small blocks, 18 bids</td>
<td>6.0696 (n.a.)</td>
<td>433</td>
</tr>
<tr>
<td>Only firms receiving small and large bids (7 firms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large blocks, 23 bids</td>
<td>7.9668 (0.293)</td>
<td>2,884</td>
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<tr>
<td>Small blocks, 10 bids</td>
<td>7.5006 (n.a.)</td>
<td>1,809</td>
</tr>
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</table>
Table 6–4: First-stage multinomial logit estimation results. Extended Model

The dependent variable is choice2: equal to 0 if a PF does not submit a bid for a firm, equal to 1 if bidpct2 < 15%, equal to 2 if 15% ≤ bidpct2 < 25%, equal to 3 if 25% ≤ bidpct2 OR coalpct2 < 50%, equal to 4 if coalpct2 ≥ 50% AND bidpct2 ≤ 25%; and equal to 5 if coalpct2 ≥ 50% AND bidpct2 > 25%. Choice2 = 0 (no bid) is the comparison group. The independent variables are described in Table 4.1. The multinomial logit model is estimated using maximum likelihood. Standard errors are in parentheses. The odds-ratio computes the changes in the probability of submitting a choice2 >1 bid versus a choice2 = 1 bid after increasing the continuous variables by one standard deviation, or changing the dummy from 0 to 1. The Wald test is a pairwise test of the restriction that the coefficients on each independent variable are equal across the equation for choice2 = 1 bids and the each equation corresponding to choice2 > 1 bids.

Panel A. Masspriv < 75%

<table>
<thead>
<tr>
<th>Variable</th>
<th>Choice 2 = 1</th>
<th>Choice 2 = 2</th>
<th>Choice 2 = 3</th>
<th>Choice 2 = 4</th>
<th>Choice 2 = 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>capital2</td>
<td>Coefficient</td>
<td>-0.00007</td>
<td>0.00195*</td>
<td>0.00161*</td>
<td>0.00265*</td>
</tr>
<tr>
<td></td>
<td>(0.0006)</td>
<td>(0.0004)</td>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td></td>
<td>1.9179</td>
<td>1.7217</td>
<td>2.4102</td>
<td>2.1274</td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
<td>0.0062</td>
<td></td>
<td>0.0000</td>
</tr>
<tr>
<td>firmshr</td>
<td>Coefficient</td>
<td>0.00032</td>
<td>0.00016</td>
<td>-0.00023</td>
<td>-0.00151**</td>
</tr>
<tr>
<td></td>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0003)</td>
<td>(0.0007)</td>
<td>(0.0008)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td></td>
<td>0.9192</td>
<td>0.7511</td>
<td>0.3889</td>
<td>0.2337</td>
</tr>
<tr>
<td>Wald test p-value</td>
<td></td>
<td></td>
<td>0.0962</td>
<td></td>
<td>0.0163</td>
</tr>
<tr>
<td>REGION</td>
<td>Coefficient</td>
<td>1.33667*</td>
<td>0.28449</td>
<td>1.07069*</td>
<td>0.18583</td>
</tr>
<tr>
<td></td>
<td>(0.4114)</td>
<td>(0.6129)</td>
<td>(0.2559)</td>
<td>(0.3423)</td>
<td>(0.2501)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td></td>
<td>0.3492</td>
<td>0.7665</td>
<td>0.3164</td>
<td>0.6478</td>
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<tr>
<td>Wald test p-value</td>
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<td>0.5804</td>
<td></td>
<td>0.0306</td>
</tr>
<tr>
<td>Reservp</td>
<td>Coefficient</td>
<td>0.00086</td>
<td>-0.00235***</td>
<td>-0.00192*</td>
<td>-0.00158**</td>
</tr>
<tr>
<td></td>
<td>(0.0011)</td>
<td>(0.0014)</td>
<td>(0.0008)</td>
<td>(0.0007)</td>
<td>(0.0007)</td>
</tr>
<tr>
<td>Constant</td>
<td>Coefficient</td>
<td>-6.18233*</td>
<td>-5.39267*</td>
<td>-4.2200*</td>
<td>-4.63483*</td>
</tr>
<tr>
<td></td>
<td>(0.5776)</td>
<td>(0.6303)</td>
<td>(0.3400)</td>
<td>(0.3518)</td>
<td>(0.3194)</td>
</tr>
</tbody>
</table>

Observations = 8784
Pseudo R\(^2\) = 0.0882
Likelihood Ratio \(\chi^2\) = 389.13
Prob >\(\chi^2\)(20) = 0.0000

*significant at 1% level; **significant at 5% level; *** significant at 10% level

(cont. on next page)
Table 6–4 (cont.)

Panel B. Masspriv $\geq 75$

<table>
<thead>
<tr>
<th>Variable</th>
<th>Choice2 = 1</th>
<th>Choice2 = 2</th>
<th>Choice2 = 3</th>
<th>Choice2 = 4</th>
<th>Choice2 = 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>capital2</td>
<td>Coefficient</td>
<td>-0.00162</td>
<td>0.00147***</td>
<td>0.00054</td>
<td>0.00156*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0016)</td>
<td>(0.0008)</td>
<td>(0.0004)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td></td>
<td>2.7159</td>
<td>2.0091</td>
<td>2.7901</td>
<td>3.0360</td>
</tr>
<tr>
<td>Wald test</td>
<td>p-value</td>
<td>0.0897</td>
<td>0.1976</td>
<td>0.0588</td>
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</tr>
<tr>
<td>firmshr</td>
<td>Coefficient</td>
<td>-0.00244</td>
<td>-0.02712</td>
<td>0.00073</td>
<td>-0.00029</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0056)</td>
<td>(0.0197)</td>
<td>(0.0016)</td>
<td>(0.0031)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td></td>
<td>0.2066</td>
<td>1.2254</td>
<td>1.1910</td>
<td>1.1426</td>
</tr>
<tr>
<td>Wald test</td>
<td>p-value</td>
<td>0.2265</td>
<td>0.5476</td>
<td>0.6437</td>
<td>0.6971</td>
</tr>
<tr>
<td>REGION</td>
<td>Coefficient</td>
<td>2.43373*</td>
<td>2.56718*</td>
<td>1.33766*</td>
<td>0.27999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.6656)</td>
<td>(0.7559)</td>
<td>(0.3442)</td>
<td>(0.6426)</td>
</tr>
<tr>
<td>Odds-ratio</td>
<td></td>
<td>1.1427</td>
<td>0.3342</td>
<td>0.1160</td>
<td>0.3164</td>
</tr>
<tr>
<td>Wald test</td>
<td>p-value</td>
<td>0.8941</td>
<td>0.1401</td>
<td>0.0193</td>
<td>0.1183</td>
</tr>
<tr>
<td>Reservp</td>
<td>Coefficient</td>
<td>0.00086</td>
<td>-0.00494***</td>
<td>-0.00067</td>
<td>-0.00123**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0011)</td>
<td>(0.0029)</td>
<td>(0.0005)</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>Constant</td>
<td>Coefficient</td>
<td>-6.44611*</td>
<td>-4.41224*</td>
<td>-4.2200*</td>
<td>-4.63483*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.7597)</td>
<td>(1.3603)</td>
<td>(0.3400)</td>
<td>(0.3518)</td>
</tr>
</tbody>
</table>

Observations =4176  
Pseudo R$^2 = 0.0588$  
Likelihood Ratio $\chi^2 = 121.22$  
Prob $>\chi^2(20) = 0.0000$

*significant at 1% level; **significant at 5% level; *** significant at 10% level
Table 6–5: Conditional expected bid prices. Extended model

The conditional mean bid prices for each bid choice are evaluated at the means of the continuous independent variables $\text{reservp}$ and $\text{Nmedbids}$ and the parameter vector estimates from unreported second-stage OLS regressions of the same type as the ones presented in Table 6.2. The means for the first two columns in each table are computed at $A1\text{firm} = 0$, the means in the second two columns at $A1\text{firm} = 1$. Bootstrapped p-values for $H_0: E[\text{bidprice of } X \text{ type of block}] - E[\text{bidprice of small blocks}] \leq 0$ are in parenthesis. Details about the bootstrapping are included in the last paragraph of Appendix E. Due to lack of sufficient number of observations, the bootstrapping methodology breaks in 56% of the runs in the model in Panel B.

Panel A. Masspriv $< 75$

<table>
<thead>
<tr>
<th>Panel</th>
<th>Round 2 Firms ($A1\text{firm} = 0$)</th>
<th>Round 1 Firms ($A1\text{firm} = 1$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log Value</td>
<td>Voucher Equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large coalitional blocks</td>
<td>7.2952 (0.023)</td>
</tr>
<tr>
<td></td>
<td>Small coalitional blocks</td>
<td>6.9479 (0.037)</td>
</tr>
<tr>
<td></td>
<td>Large single blocks</td>
<td>7.1662 (0.057)</td>
</tr>
<tr>
<td></td>
<td>Medium single blocks</td>
<td>6.0868 (0.214)</td>
</tr>
<tr>
<td></td>
<td>Small blocks</td>
<td>4.8824 (n.a.)</td>
</tr>
</tbody>
</table>

Panel B. Masspriv $\geq 75$

<table>
<thead>
<tr>
<th>Panel</th>
<th>Round 2 Firms ($A1\text{firm} = 0$)</th>
<th>Round 1 Firms ($A1\text{firm} = 1$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log Value</td>
<td>Voucher Equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large coalitional blocks</td>
<td>7.1041 (0.296)</td>
</tr>
<tr>
<td></td>
<td>Small coalitional blocks</td>
<td>6.3584 (0.317)</td>
</tr>
<tr>
<td></td>
<td>Large single blocks</td>
<td>6.2973 (0.362)</td>
</tr>
<tr>
<td></td>
<td>Medium single blocks</td>
<td>8.4461 (0.287)</td>
</tr>
<tr>
<td></td>
<td>Small blocks</td>
<td>2.1465 (n.a.)</td>
</tr>
</tbody>
</table>
7.1 Extensions to the theoretical model

7.1.1 Extensions to the single large investor model

The model in Chapter 3 can be extended in several directions. One extension, relevant for applications of the model to investors concentrated within a certain industry, is to allow for synergies between firms. The fact that a single investor may own blocks in two or more firms in the same industry may affect the expected returns on each investment. Classic portfolio theory advises investors to hold securities that have low return correlation (most likely securities in different industries). In a world where accumulation of large blocks of shares and control is possible, it may be optimal for a large investor to corner a whole industry and offset the costs of lower diversification with monopoly rents or economies of scale. The portfolio problem of investors in such setting is related to the analysis of mergers and acquisitions. The reasons behind horizontal or vertical integration, and the identities of the merging firms can be addressed using the extended model.
Another extension of the model is to make the variance-covariance matrix of firm returns dependent on the ownership structure of firms in the economy. There is extensive research on the effect of firm value of a large block holder, but little work on changes in firm risk due to changes in firm ownership structure\(^{50}\). A large part of the fluctuations in firm value is also due to events related to competitors in the same industry. It may be optimal for an investor that owns more than one firm in an industry to reduce competition between firms, which may result in lower firm risk. Similar to the extension outlined in the previous paragraph, the variance-covariance matrix of returns will then be a function of not only the ownership structure of each firm but also of the types of portfolios of large blocks that investors accumulate and especially the cross-ownership of firms in the same industry.

In many countries, there are ownership and voting structures that deviate from the one share – one vote rule. Examples include pyramidal structures and dual-class shares. Moreover, in a firm with many unorganized small shareholders complete control may be achieved with an equity block that is much smaller than 50%. A simple way to accommodate such separation of ownership and control, assuming that the voting rules are fixed at time \(t = 0\), is to redefine on a firm-by-firm basis the function \(p(\alpha_i)\). The functional form in Gambarelli (1983) can be used as a starting point and then extended with the possibility of ex ante coalition formation. If full control can be obtained with a smaller block of shares, then the portfolios of large investors need not be as concentrated, resulting in a decrease of portfolio risk. This effect is equivalent to a budget increase.

\(^{50}\) Huddart (1993) is one example of a model of moral hazard in a single firm that results
Last, an extension of the model may allow investors to choose whether to place their money in an institution or invest on their own. APZ address partially this issue by endogenizing the risk aversion coefficient in the utility function of the large investor. Another line of research describes the optimal mutual fund size, where only liquidity and transaction costs are the only difference between individual and institutional investors\(^{51}\).

In the baseline model presented in this paper an increase in \(L\)’s capital has only positive effects on \(L\)’s utility. In order to avoid a corner solution where all investors deposit their money in \(L\) and a single investor owns all firms in the economy, the model has to be extended to include either agency costs that increase in \(L\)’s size or a monitoring budget constraint. This will provide an interior solution for the optimal budget of an institution that balances the benefits associated with larger capital size with the larger agency costs.

### 7.1.2 Multiple Strategic Investors

The theoretical model in Chapter 3 makes the strong assumption that only one large investor exists. The model can be extended to incorporate strategic interactions between more than one large investor. Several new features arise. The prices, at which a large investor can buy blocks in firms will be affected not only by the size of the block, but also by the bidding of other large investors interested in these particular firms. The prices of blocks determine directly the expected returns from buying these blocks. Therefore, the portfolio problem of a large investor has to take into account the bidding

\(^{51}\) Chordia (1996) and Nanda, Narayanan, and Warther (2000)
strategies of all other large investors and the resulting relationship between price and block size. This part of the problem can be modeled as an auction, where the set of atomistic shareholders will be the seller and the large investors will submit bids that consist of price and quantity pairs. The analysis of the auctions has to account for observable budget constraints and the fact that there is more than one simultaneous auction (one for each firm).

Besides the effect on stock prices, the existence of other strategic investors has another effect on the return from owning a large block. The size of the private benefits of control for a particular institution in a particular firm will depend not only on the size of its own stake, acquired in the auction, but also on the stakes of other institutions in the same firm. This part of the model can be modeled as a bargaining game between the large shareholders of a firm, given the stakes that they acquired in the first-stage auction\textsuperscript{52}.

The solution for equilibrium in this complex multi-stage game can proceed as follows. First, the bargaining sub-game at the last stage will be solved using either a Shapley Value or the more advanced concept of Negotiation Value introduced by Gomes (1999). The aim is to be able to calculate, given a vector of ownership stakes of all large shareholders in a firm, what is the value of each block of shares to its owner.

The last period values will determine the optimal bidding strategies for each large investor. In equilibrium every large investor will be able to forecast the price of a block

\textsuperscript{52} Another way to think about the problem is to view the initial auction stage as the purchase of toeholds. Then, on the secondary market, the institutions may trade among each other and post tender offers for blocks of shares in order to achieve full control over a company. The bargaining game then reduces to finding out at what price will a blockholder sell out his holding in a company.
of shares that he has to pay if he decides to bid. The portfolio problem for each large investor can then be solved and the equilibrium ownership structures for all firms will be derived. A feature of the extended model is that co-operative *ex ante* agreements between several parties may arise as optimal diversification tools. Consider the following strategy. Two or more large investors each buy part of a controlling block and then split the proceeds from having control in the firm proportionally to their stake. The investors will gain the expected return of a controlling blockholder at a substantially lower risk because this investment will have a smaller weight in their portfolio. In order for the contract to be enforced, these investors can buy joint controlling ownership in more than one firm. A deviation from the agreement in one firm will thus become more costly.

After the model is developed, several empirical predictions can be outlined. Below, I provide a preliminary description of some of them.

First, the equilibrium portfolio allocations have particular patterns of matching firms with investors. Low budget investors will concentrate in small firms, while high budget investors can buy controlling stakes in large firms at low competition from other investors. Investors, located in a particular region will be more likely to bid for firms in the same region. Investors with a comparative advantage in extracting private benefits of control in certain firms will bid for those firms. All these matching patterns can be documented using real-life data.

Second, investors will form coalitions to reduce their portfolio risk and increase their portfolio returns. In general, the same coalition will buy controlling blocks in more

---

An interesting issue to be explored further is what is the effect of different trading
than one firm in order to enforce the collusive agreement between its members. A larger part of the capital of each of the coalition members will be dedicated towards buying controlling blocks. There will be a pattern of matching where large investors make coalitions with investors of similar size, and after the large investor coalitions have been formed, the smaller investors will also form coalitions of their own or if they are too small will stay independent.

Last, the prices submitted by coalitions of investors that have agreed to jointly acquire a controlling blocks will be higher than the prices submitted by single investors. The prices bid for large firms will be lower because large firms will attract a smaller number of investors (only large players) and competition for buying blocks in them will be low. In order for these predictions to be tested several new tools and empirical models need to be first developed. These tools and models are described in the Chapter 7.2.

7.2 Development of new tools for strategic investing and extensions to the empirical tests

Chapter 7.2.1 below outlines three tools that facilitate the decision making of strategic investors in an environment where equity returns are strongly influenced by corporate control. In Chapter 7.2.2 these tools are used to design additional tests of the theoretical model in Chapter 3 and its extensions in Chapter 7.1.
7.2.1 Tools for strategic investing

7.2.1.1 Coalition formation

The first tool is designed to detect voting coalitions and shareholder syndicates by identifying an abnormal number of repeated interactions, where the same two investors own equity in many firms. After the shareholder coalitions have been identified, the firm ownership structure can be adjusted and then the next two tools described below can be applied more accurately. The methodology proceeds in two steps. At the first step a matching function is estimated that computes what is the normal ownership overlap between two investors given the number of investments that each owns. The estimated matching function then allows for the identification of an abnormal number of overlapping portfolio investments. The second step involves the generation of a graph where the nodes correspond to investors and the arcs denote abnormal portfolio overlap. The disconnected parts of the graph are sets of friendly bidders or strategic syndicates.

The methodology has wide applications in Industrial Organization research on market competition. Long-term coalitions between investors or firms reduce competition. A measure of competitiveness of an industry has to account for the coalitional structure of firms in the industry. Instead of looking at Herfindahl indices and other measures of competition that focus on a single market, the tool described in this accounts for the possibility of collusion due to repeated interactions through multi-market overlap. A measure of competition is not the number of firms, but the number of disjoint syndicates.
that operate in a market. One direct application is to measure the multi-market overlap of Nasdaq dealers (the same two dealers making markets in a large number of securities), map the pairs of overlapping dealers into friendly syndicates, and relate the resulting opportunities for collusion to measures of transaction costs and dealer profits. The estimated syndicates can be also compared to the underwriting syndicates.

7.2.1.2 Power indexes and strategic investing

The generalized equity valuation model in Equation 2.1 separates the equity analysis into two parts. The first part is the classic earnings or cash flow forecasts. The second part is maximizing the function \( \kappa \). The second tool takes a given ownership structure of a set of large blockholders and an ocean of atomistic shareholders and determines the size of the equity block that can be purchased from the ocean that maximizes \( \kappa \), measured as the ratio of control power per share. The purchase of this optimally sized block results in obtaining the highest possible return on an equity investment in the given firm. Control power per share can be measured by either the Coleman-Banzhaf power index or the Shapley-Shubik/Oceanic Shapley power index. The methodology utilizes and extends an algorithm developed by Gambarelli (1982) and Arcaini and Gambarelli (1986), but adds the size of the equity block in the denominator, and the adjustment for coalition structures proposed by Chapter 7.2.1.1. For any ownership structure, it will be straightforward to find the block with a maximum \( \kappa \). For a fixed firm value, this block will maximize the return from an equity investment in a firm.
Besides strategic investors in emerging markets, this tool is useful for the decision making of corporate raiders that establish toeholds in order to extract greenmail, takeover arbitrageurs, or firm managers that plan to increase their control position through private placements of newly issued equity to friendly investors.

7.2.1.3 Ownership and control structures

The third tool is a measure of the separation of ownership and control at the firm level. It is based on a theoretical construct in Bennedson and Wolfenzon (2001). There, the authors show how to generate the optimal ownership structure that maximizes the cash flow rights of the minimal controlling coalition. Given an actual firm ownership structure (distribution of control and equity rights), this ownership structure can be compared to the optimal (in the sense of Bennedson and Wolfenzon (2001)) ownership structure and a difference measure can be computed. Large shareholders in firms that largely deviate from the optimal ownership structure have stronger incentives to expropriate the wealth of minority shareholders and can do so at lower costs. Such firms are good targets for strategic investing and hostile takeovers and other control contests.

\[54\text{ To my knowledge, this is one of the first measures of the separation of ownership and control at the firm level. Most existing approached measure the separation of ownership and control separately for each equity block.}\]
7.2.2 Additional empirical tests

7.2.2.1 Coalition formation during the Bulgarian mass privatization auctions

Coalitions of PFs identified by the tool in Chapter 7.2.1.1 can be classified in the following three types: 1) a coalition of equal large blocks that is a long-term governing commitment; 2) a repeating 34%+17%. 17%+34% bidding signifying a repeated interaction to ensure exchange of blocks when they shares start trading on the BSE or a stable risk-sharing and cross-ownership arrangement; 3) dynamic bidding coalitions where a large block holder asks several funds to bid for small blocks on his behalf. After the different types of coalitions have been identified, the predictions about coalition formation outlined in Chapter 7.1 can be tested by exploring the determinants of coalitional choice. One simple model that can be estimated at the level of a PF is to form a dependent variable equal to the percent of coalitional investments in the PF portfolio and regress that on fund specific explanatory variables like capital, style, and location. A multinomial logit model for each of the different types of coalitions can also be estimated.

7.2.2.2 Portfolio selection of large investors

One possible critique of the empirical methodology in Chapter 6 is that the investment decisions of each of the institutional investors should be modeled not separately for every firm, but for whole portfolios of firms. To my knowledge there is
still no empirical methodology in the literature to address this scenario. To make the econometric model tractable, I had to make one strong assumption – the bidding decisions of each fund for different firms are not correlated. This independence assumption is violated because every PF has a single budget to be distributed among all bids she submits.

A comprehensive empirical analysis at the portfolio level will not only relax the strong independence assumption, but also provide further evidence on the factors influencing the investment decisions of institutions in a high private benefits of control environment. The analysis can start with summary statistics of the resulting portfolios of the 81 PFs after the auctions. The empirically observed ownership stakes can be compared with the ideal ownership stakes that maximized the power per share ratio given by the tool proposed in Chapter 7.2.1.2. If the actual investments by PFs cluster around the blocks generated by the theory, then this provides evidence that control is an important determinant in equity investments and that the PFs managers successfully maximize the control power per share of their portfolios. Also, a simple regression analysis can relate the average power-per-share ratio of each PF to the size of the fund, its participation in coalitions, geographic location, or other fund characteristics. This empirical analysis extends the findings of the Law and Finance literature about the relationship between ownership structure and control by adding the investor perspective. The results are that in a market with low investor protection, most investors will form concentrated portfolios of large blocks.
The dissertation focused only on the bids at the second auction round and ignored data on the portfolios formed by PFs at the first auction round. The portfolio of firms acquired at the first round of the mass privatization auctions may determine the bidding behavior of the privatization funds at the second auction round. For example, an institution that has managed to acquire large blocks in a substantial number of firms of a particular industry at the first round may be more likely to submit high prices when bidding for other firms in the same industry at the second round of the auctions. An analysis of the dynamic bidding decisions of the privatization funds on all three auction rounds and the subsequent trading at the Bulgarian Stock Exchange requires a dynamic discrete choice framework. Creating this structural model and estimating its parameters offer additional venues for future research.

**7.2.2.3 Firm ownership structures**

The last proposed extension to the empirical work in the dissertation is to compute the Bennedsen and Wolfenzon (2000) optimal cash flow ownership structures for each firm with more than 50% offered for mass privatization. Then, the distribution of different types of optimal cash flow structures can be compared to the distribution of actual ownership structures. Deviation statistics can be reported as another evidence of the separation of ownership and control in application of the tool proposed in Chapter 7.2.1.3. Furthermore, a firm-level probability model can be estimated that will detect what are the determinants different ownership structures obtained among firm specific characteristics like size, region, industry, exports, % for mass privatization, number of
PFs in the same region or industry. Such study of firm ownership structures makes one extra step compared to existing studies like Demsetz and Lehn (1985) or Demsetz and Villalonga (2001), which take firm ownership as given and describe its cross-sectional variation. The proposed study starts with the portfolio problem of a large investor, solves the equilibrium with coalitions, and then derives the cross-sectional resulting ownership structures.
Chapter 8

CONCLUSION

This dissertation incorporates corporate control into equity investments. The major contributions are as follows. First, the dissertation provides an extension of existing equity valuation and portfolio theory through the introduction of the notion that the return on an equity investment may depend on the control power of the investment. Second, the dissertation derives predictions about the optimal portfolios for strategic investors facing private benefits of control, monitoring, and budget constraints. Third, the implications of the theoretical model are tested empirically using a unique data set. Last, the empirical results provide evidence for the existence and actual size of the private benefits of control.

The theoretical framework of this dissertation is mostly relevant for the developed economies of Continental Europe, East Asia, and all emerging markets. In the US, one prominent set of investors that behaves according to the primitives of the model is the set of venture capitalist funds. Most of the venture capitalist investments are in large blocks of equity. VCs contribute actively to the performance of all firms in their portfolios. The premises of the theoretical model are close to the institutional details of the venture capital industry. Moreover, a large number of venture capitalist investments are in the form of syndicates where several venture capitalist funds invest jointly in a single company. The syndicates map directly into the coalitions that arise endogenously in one of the extensions to the theoretical model outlined in Chapter 7. The framework
developed here suggests a consistent approach of how to analyze the portfolios of this set of investors and document their investment and risk management strategies.

With some minor extensions, the theoretical model and the empirical estimation methodology proposed here can be implemented in the analysis of other frictions like transaction costs that may cause expected returns to be correlated with the size of an investment. Consider the case of a mutual fund that is facing trading costs that are increasing with trade size. Even though the mutual fund is not likely to monitor managers and in most cases has no control over the distribution of firm cash flows, still the size of an investment in a stock affects the return on this investment. The trading environment of each stock and especially its liquidity will affect the portfolio optimization problem of the mutual fund. The mutual fund will attempt to spread its capital across more liquid and larger market cap firms because those will have lower trading costs. A direct prediction stemming from this fact is that most mutual funds will attempt to minimize the ratio of their own size to the market value of the companies they invest in.

The strategic interaction between large investors is also important in this scenario because the type of trading behavior of the existing owners of a stock determines its liquidity. On one hand, if flows into mutual funds and their trading are not correlated, a mutual fund will be more likely to trade in stocks where there are other mutual fund trading because the possibility of quickly finding a counter-party to trade is increased. On the other hand, if institutional investors herd and their buys and sells are highly correlated, it is optimal for the mutual fund to invests in stocks where there are no other
institutional investors. This and other extension of the theoretical model and its empirical applications to US institutional investors are left for future research.

The empirical work in the dissertation provides a measure of private benefits of control that improves along several dimensions on previous studies of the control premium. The estimates of the control premium in the dissertation are free of selection bias because the decision making process of investors is explicitly modeled. The Bulgarian mass privatization setting offers a natural experiment that alleviates the problem of endogeneity of ownership and control. The legal environment provides an extreme case where the law does not restrict a majority shareholder in any major ways and the raw value of control can be readily observed. In this environment, as the model predicted and the estimation results confirmed, besides risk and expected return, other factors like investor capital, firm size, and expected control benefits influence the portfolio decisions of large investors.

The premium for control is computed to be orders of magnitude larger than the control premium documented in the USA and several times larger than the premium implied by the difference of prices of dual class shares in other developed markets. The large difference in the control premium in Bulgaria, as opposed to the value of control in the USA and other developed countries, is mostly due to differences in the legal environments. An extensive literature starting from DeAngelo, DeAngelo, and Rice (1984) and extended and summarized by Holderness and Sheehan (2000) has empirically shown that the American legal system leaves majority shareholders few opportunities to
extract wealth from small shareholders. That is why the value of control in the US is usually very small.

In comparison, the legal environment in Bulgaria does not strongly protect the ownership rights of small shareholders. The developments after the privatization auctions clearly illustrate this fact. During the first month after all firms started trading on the Bulgarian Stock Exchange the overall trading volume was high. The main part of the trading consisted of cross-trades where privatization funds were exchanging minority blocks as part of the coalitional agreements described in Chapter 4. Individual investors were not buying any shares at the stock exchange and were selling to the large shareholders the shares they acquired at the mass privatization auctions. The small investors that sold their shares at this stage managed to secure a sizable return. This is not true for the majority of small shareholders that kept their shares. In many firms after a large shareholder obtained majority, either through cross-trades or buying shares from individuals, she diluted the ownership rights of the remaining shareholders. Consequently, the stock prices of most firms with a majority shareholder dropped dramatically. At that time many companies went private with the shares of minority shareholders being frozen-out at large discounts compared to the stock prices during the period of large block accumulation. Now all equity of the privatized companies is concentrated into the hands of large investors and there is virtually no trading in small blocks of shares on the BSE.

The effect of corporate control on the investment decisions of individuals and institutions was so strong that the whole stock market failed to emerge. Such an empirical
phenomenon cannot be explained by classic investment theory. Only a full model that incorporates control into equity valuation, such as the model developed in the dissertation, can predict the failure of capital markets in most transitional and other economies, where minority shareholder protection is inadequate.

The extended equity valuation model shows why classic tools of fundamental or technical investment analysis may fail in identifying good investment opportunities in international markets. Earnings forecasts or other measures of future firm performance assume that cash flows to the corporation are the same as cash flows to investors. These tools will be not very useful for the decision making of potential investors in such markets, because no matter what is the firm performance, the value of investor cash flow rights of will be almost zero if there is not enough voting power or legal mechanisms to enforce these rights.

The basic recommendation of the theoretical methodology and the empirical analysis in the dissertation is that small investors in emerging markets should buy equity in companies that do not have a majority shareholder and several large shareholders are competing for acquiring control. They should especially avoid companies where a majority shareholder has appeared only recently and the where the process of “tunneling” assets is at its peak. Predicting control contests in companies in markets with low investor protection. can generate high returns for small investors in such markets. Another possible way to maximize the control value of equity investments made by individuals is for them to deposit the capital in domestic-based large institutions. By accumulating substantial capital, such large strategic investors can invest in low-protection and form
portfolios of blocks with large voting power thus obtaining both much higher returns and lower portfolio risk
BIBLIOGRAPHY


Amihud, Yakov, and Amir Barnea, 1974, Portfolio selection for managerial control, *Omega, 2*, 775-783.


Demsetz, Harold, and Belen Villalonga, 2001, Ownership structure and corporate performance, Working paper, UCLA.


Heckman, James, 1976, The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models, *Annals of Economic and Social Measurement, 5*, 475-492.


Miller, Jeffrey, and Stefan Petranov, 2000, The first wave of mass privatization in

Milnor, John, and Lloyd Shapley, 1978, Values of large games II: Oceanic games,

Nanda, Vikram, M.P. Narayanan, and Vincent Warther, V., 2000, Liquidity, investment

Nenova, Tatiana, 2001, The value of corporate votes and control benefits: A cross-
country analysis, Working paper.

Ohlson, James, and William Ziemba, 1976, Portfolio selection in a lognormal market
when the investor has a power utility function, *Journal of Financial and
Quantitative Analysis, 11*, 57-71.

Roe, Mark, 1990, Political and legal restraints on ownership and control of public

Shapley, Lloyd, and martin Shubik, 1954, A method for evaluating the distribution of

9*, 277-293.

Shleifer, Andrei, and Robert Vishny, 1986, Large shareholders and corporate control,


A.1 Proof of Lemma 1

Given the timeline of the model, \( L \) chooses the optimal level of diversion after the liquidation value of the firms has been revealed. Therefore, in computing the optimal value of diversion, \( L \) can ignore any effects on the \textit{ex ante} variance of his wealth. Let \( W(\hat{E}) \) denote \( L \)’s wealth when the vector \( \hat{E} \) of liquidation values of all firms is known:

\[
W(\hat{E}) = \sum_{i=1}^{N} \left[ (\hat{E}_i S_i + m_i) \alpha_i + p_i [b_i - \theta_i \alpha_i](\hat{E}_i S_i + m_i) - c_i \right] \quad (A.1)
\]

The optimal value of \( \theta \) solves the following FOC:

\[
\frac{\partial W(\hat{E})}{\partial \theta} = 0 \quad (A.2)
\]

Given Assumption 6, the system of \( N \) equations simplifies to the following equation that has to be true for all \( i = 1 \) to \( N \):

\[55\] The same proof for a risk-neutral agent and a single firm can be found in Burkart, Gromb and Panunzi (1998), and Bennedson and Wolfenzon (2000). It is included here for completeness. The only thing that I need to show is that the risk-aversion of \( L \) does not change the optimal solution for \( \theta_i \), because at the time when the values of \( \theta_i \) is chosen,
or the optimal values of $\theta_i$ for all $i$ solve:

$$b_i'(\theta_i) = \alpha_i$$  \hspace{2cm} (A.4)

Equation 3.7 follows directly from A.4. The second order conditions for a maximum are satisfied given Assumption 4, which also assures that the optimal values of $\theta_i^*$ lie in the interval $(0, 1)$. This satisfies Equation 3.5. Note that the optimal value of $\theta$ does not depend on the actual value of $\hat{E}$. This is an important result that allows for the optimal solution of $\theta_i$ to enter directly in the optimization problem faced by $L$ at time $t = 0$.

Q.E.D.

A.2 Proof of Corollary 1

A.2.1 Part 1.

Given Assumption 5, $b_i''(\theta_i) < 0$ for all $\theta_i$. This implies that $b_i'(\bullet)$, and therefore also $b_i'^{-1}(\bullet)$ are monotonously decreasing functions in their argument, which leads to a negative relationship between block size and level of diversion.

the only random variables $E_i$ in the model have been revealed. Assumption 6 assures that
A.2.2 Part 2.

The net gains of benefits of control as percent of firm cash flows are given by \( \pi_i = b_i(\theta_i^*) - \theta_i^* \alpha_i \) for \( \alpha_i \geq 0.5 \). The first derivative of \( \pi_i \) is:

\[
\frac{\partial \pi_i}{\partial (\alpha_i)} = b_i'(\theta_i^*) \frac{\partial \theta_i^*}{\partial (\alpha_i)} - \theta_i^* - \frac{\partial \theta_i^*}{\partial (\alpha_i)} \alpha_i
\]  

(A.5)

but by Lemma 1, \( b_i'(\theta_i) = \alpha_i \). As a result, \( \frac{\partial \pi_i}{\partial (\alpha_i)} = -\theta_i^* < 0 \). Or, for all \( \alpha_i \geq 0.5 \), \( \pi_i \) is monotonously decreasing in \( \alpha_i \). Therefore, in the interval \([0.5, 1]\), \( \pi_i \) has a unique maximum at \( \alpha_i = 0.5 \).

A.3 Proof of Lemma 2

The monitoring technology was assumed to be deterministic and therefore it does not affect the variance of the portfolio. The optimal level of monitoring \( m \) has to satisfy the following first order conditions:

\[
\frac{\partial E[W(\hat{E})]}{\partial m} = 0
\]  

(A.6)

Using the fact that \( E[W(\hat{E})] = W(E) \), and given Assumption 6, the FOC reduce to the following equations for \( m_i^* \) that have to be satisfied for all \( i = 1 \) to \( N \):

the solution for the single firm case automatically extends to the multiple firm case.
If $p_i$ equals the indicator function $i \{ \alpha_i \geq 0.5 \}$, then the equations reduce to:

$$c_i' (m_i^*) = \alpha_i, \text{ for } \alpha_i \in [0, 0.5)$$  \hspace{1cm} (A.8)

and

$$c_i' (m_i^*) = \alpha_i + b_i (\theta_i^*) - \alpha_i \theta_i^*, \text{ for } \alpha_i \in [0.5, 1]$$  \hspace{1cm} (A.9)

The second order conditions for a maximum are satisfied given Assumption 4.

Assumption 4 also assures that the optimal solution for $m_i$ is greater or equal to zero thus satisfying Equation 3.6.

Q.E.D.

A.4 Proof of Lemma 3

The total value of the firm for minority shareholders if $L$ has a controlling block is equal to $\left( E_i S_i + m_i^* (1 - \theta_i^*) \right)$. The value of the firm under dispersed ownership is equal to $E_i S_i$. Let the net gain be denoted by $G_i$. The function $G_i$ is given by A.10:

$$G_i = m_i^* (1 - \theta_i^*) - \theta_i^* E_i S_i$$  \hspace{1cm} (A.10)

Given Assumption 3c and 4a, and Lemmas 1 and 2, the expressions for $\pi_i^*$, $\theta_i^*$, and $m_i^*$ are as follows:
Plugging the expressions for \( \theta_i^* \), and \( m_i^* \) in A.9 and simplifying, we get:

\[
G_i = \left[ \left( \frac{1 + \alpha_i^2}{2\gamma_i} \right) \alpha_i - (1 - \alpha_i) E_i \right] S_i
\]

(A.14)

From here Equation 3.12 follows directly after we divide the net gain \( G_i \) by the number of shares \( S_i \).

Q.E.D.

A.5 Proof of Corollary 2

Taking first derivatives of Equation 3.12 we get the following results:

\[
\frac{\partial g_{i}}{\partial \alpha_i} = \frac{1}{2\gamma_i} \left( 1 + 3\alpha_i^2 \right) + E_i > 0, \text{ for all } \alpha_i \in [0.5,1), E_i \geq 0, \ \gamma_i > 0
\]

(A.15)
\[ \frac{\partial g_i}{\partial \gamma_i} = \left( \frac{1 + \alpha_i^2}{2\alpha_i} \right) \gamma_i^{-2} < 0, \text{ for any } \gamma_i > 0 \]  \hspace{1cm} (A.16) \\

\[ \frac{\partial g_i}{\partial E_i} = -(1 - \alpha_i) < 0, \text{ for all } \alpha_i \in [0.5, 1) \]  \hspace{1cm} (A.17) \\

Q.E.D.

**A.6 Proof of Lemma 4**

Let \( w_i \) denote the portfolio weight of an investment in firm \( i \). The expected return of the portfolio is equal to A.18:

\[ E(R_p) = \sum_{i=1}^{N} w_i (E - 1) = (E - 1) \sum_{i=1}^{N} w_i = E - 1 \]  \hspace{1cm} (A.18) \\

The return on any portfolio of firms with equal returns is equal to a constant regardless of the weights. Now, the only thing that \( L \) needs to assure is that his portfolio has minimum variance. Or, \( L \) has to solve the following simple minimization problem A.19:

\[ \min \sum_{i=1}^{N} w_i^2 \sigma^2 \]  \hspace{1cm} (A.19) \\

\[ \text{s.t. } \sum_{i=1}^{N} w_i = 1 \]

The problem reduces to A.20
\[
\min \sum_{i=1}^{N} w_i^2
\]

s.t. \( \sum_{i=1}^{N} w_i = 1 \)  

It is easy to show that the solution of the problem is given by A.21:

\[
w_1 = w_2 = \ldots = w_N = \frac{1}{N}
\]

The resulting portfolio variance is A.22:

\[
\sigma_p^2 = \sum_{i=1}^{N} \left( \frac{1}{N} \right)^2 \sigma_i^2 = N \left( \frac{1}{N^2} \right) \sigma^2 = \frac{\sigma^2}{N}
\]

Q.E.D.

**A.7 Proof of Lemma 5**

Given the setting described in Chapter 3.2, and the fact that stock returns are normal, it is easy to show that maximizing expected utility is equivalent to considering only mean-variance efficient portfolios. If private benefits of control do not exist, the only mean-variance efficient portfolio is given by Lemma 4. With private benefits of control, some of \( L \)'s capital will be invested in blocks \( \alpha_i^* \geq 0.5 \), and the rest will be invested in the portfolio of Lemma 4. Lets assume that at the optimal portfolio at least for
one firm $i$, the optimal stake $\alpha^*_i > 0.5$. The following will show that this portfolio cannot be mean-variance efficient. Let the return on the investment in firm $i$ be $R_i$, where:

$$R_i = \frac{E_i S_i (\alpha^*_i + \pi^*_i) - S_i \alpha^*_i}{S_i \alpha^*_i} = E - 1 + \frac{E \pi^*_i}{\alpha^*_i} \quad (A.23)$$

The first derivative of $R_i$ with respect to $\alpha^*_i$ is given by $A.24$:

$$\frac{\partial R_i}{\partial \alpha^*_i} = \frac{E_i \frac{\partial \pi^*_i}{\partial \alpha^*_i} \alpha^*_i - E_i \pi^*_i}{(\alpha^*_i)^2} = \frac{-E \theta^*_i \alpha^*_i - E \pi^*_i}{(\alpha^*_i)^2} < 0 \quad (A.24)$$

Denote by $\sigma^2_i$ the contribution of investment in firm $i$ to the risk of the portfolio. $\sigma^2_i$ is given by $A.25$:

$$\sigma^2_i = (\alpha^*_i + 2 \pi^*_i)^2 S_i^2 \sigma^2 \quad (A.25)$$

The first derivative of $\sigma^2_i$ with respect to $\alpha^*_i$ is:

$$\frac{\partial \sigma^2_i}{\partial \alpha^*_i} = 2 S_i^2 \sigma^2 \left(\alpha^*_i + 2 \pi^*_i\right) (1 - 2 \theta^*_i) \quad (A.26)$$

Given Assumption 4 and Lemma 1, $(1 - 2 \theta^*_i) > 0$, for all $\alpha^*_i > 0.5$. The first derivative of $\alpha^*_i$, is then always greater than zero.

If the first derivative of $R_i$ with respect to $\alpha^*_i$ is smaller than 0 for any $\alpha^*_i > 0.5$, then $L$ can increase the return on this investment and therefore the return on his whole
portfolio by decreasing $\alpha_i^*$, and placing the resulting excess capital in the portfolio of Lemma 4. This will result in an additional decrease in portfolio risk because the derivative of $\sigma^2$ is positive. Thus, a portfolio that has at least one investment $\alpha_i^* > 0.5$ is not efficient. A reduction of the investment $\alpha_i^*$ to $\alpha_i^* = 0.5$ increases portfolio expected return and decreases portfolio variance. No mean-variance efficient portfolio will have a weight $\alpha_i^* > 0.5$ for all $i = 1$ to $N$.

Q.E.D.

A.8 Proof of Proposition 1

Proposition 1 can be easily proved for a relaxation of the original Knapsack Problem that allows for divisibility of the items. In this case, an analytical solution exists that is described by a simple “Greedy Algorithm”. The algorithm sorts all items on $v_i/s_i$ in decreasing order. Then it picks the items with the highest $v_i/s_i$ that can fit in the knapsack. The last item will fit partially and the algorithm ensures that the sum of the values of items in the knapsack is maximized.

The Knapsack Problem in general has no closed-form solution. Plenty of algorithms exist that achieve a fast exact solution or approximations to the solution if the size of the problem is large. The algorithms that provide an exact solution of the general Knapsack Problem select items with as high $v_i/S_i$ ratio as possible, but a simple description of the resulting optimal solution is not available. Therefore, Proposition 1 cannot be proved analytically, but is holds in a probabilistic sense. See the analysis in Chapter 3.2 for numerical tests of Proposition 1.
A.9 Proof of Corollary 3

(i) The derivative of the value-to-size ratio with respect to firm size $S_i$ is:

$$\frac{\partial \left( \frac{v_i}{S_i} \right)}{\partial S_i} = -\frac{\rho}{8} (1 + 2\pi_i)^2 \sigma^2 < 0,$$

for all values of the parameters $\sigma^2$ (A.27)

(ii) The derivative of the value-to-size ratio with respect to $\pi_i$ is:

$$\frac{\partial \left( \frac{v_i}{S_i} \right)}{\partial \pi_i} = E - \frac{\rho}{4} S_i \sigma^2 (1 + 2\pi_i),$$

(A.28)

If $\sigma^2$ is within a reasonable region (0.01, 0.25), A.28 is positive for values of $\rho$ well above 10. Thus, for all reasonable values of the parameters the value-to-size ratio is an increasing function in the net gain from control $\pi_i$.

Q.E.D.
Appendix B

DESCRIPTION OF THE EXPERIMENT DESIGN

Let a “scenario” denote a set of the following 6 parameters: $E$, $\rho$, $\sigma^2$, $N$, $Max_\pi$, and $Max_s$. The values of the parameters used in the baseline scenario are as follows: $E = 1.05$, $\rho = 2$, $\sigma^2 = 0.04$, $N = 50$, $Max_\pi = 0.125$, $Max_s = 2$. Other scenarios were simulated where 5 out of 6 parameters were kept at their baseline values, while changing the remaining parameter around its baseline value. For each scenario, I generate in Matlab 100 random draws of two $1 \times N$ vectors, a vector $S$ drawn from a uniform distribution with support $(0.001, Max_s)$, and a vector $\Pi$ drawn from a uniform distribution with support $(0, Max_\pi)$. Then, for every firm $i = 1$ to $N$ in each run $t = 1$ to 100, I compute $v_{it}$ (the increment to the certainty equivalent of $L$ if a majority block in firm $i$ is bought) and the corresponding value-to-size ratio.

The $v_{it}$ and $s_{it}$ vectors are the inputs for the KP solution algorithm\(^56\). For every set of vectors $v_{it}$ and $s_{it}$, 20 KP problems are solved, each with a different value of the capital of $L$ ranging from 0.05 to 1 in increments of 0.05\(^57\). The output from the exact solution of each of the 2000 problems for each scenario is the certainty equivalent of the optimal

\(^56\) The vectors $v$ and $s$ are discretized by multiplying by 1000, and then taking the integer value of the result.

\(^57\) The actual value used in the algorithm is $\phi \times 2000$ because of the discretization.
portfolio and a vector of the included firms in the portfolio. The output plus the input vectors provide the data for the analysis in Chapter 3.2.

58 The KP problems were solved using the ACM 632 algorithm described in Martello and Toth (1985) and written in Fortran. The solution of a set of 2000 KP problem takes from 0.5 to 1.5 sec. on a node at the Penn State IBM RS/6000 system.
Appendix C

UPWARD SLOPING STOCK SUPPLY CURVES

Empirical market microstructure research has shown that the price at which an investor can buy a block of shares is usually increasing in the size of the block. In this appendix, I relax Assumption 1, and derive the functional form of the relationship between purchase price and block size for one stylized trading environment59. This particular environment is chosen for its simplicity60.

Assume that for each firm $i$, there are $K_i$ atomistic shareholders, each of which is willing to buy a single share. For now, let $K_i > S_i$ for all $i = 1$ to $N$. The shareholders are passive in the sense that they are not aware of or ignore the presence of $L$. The population of values of the atomistic shareholders for shares in firm $i$ follows some distribution $\Phi_i$ over a compact support $[0, P_{i,max}]$. The c.d.f of $\Phi_i$ is denoted by $F_i(x)$. The original owners of the firms are also assumed to be passive. They sell all their shares $S$ on non-discriminatory (second price) auctions. It is easy to show that every atomistic shareholder

59 The results obtained in this environment also hold in a setting where $L$ announces an offer for $s_i$ shares through either a Dutch type auction as in Bagwell (1991, 1992) or a fixed price tender offer as in Stulz (1988).

60 Other environments that can also be considered at the cost of substantial mathematical complexity include a Walrasian equilibrium with strategic atomistic shareholders (APZ, or Madhavan (1992 - the section on batch auctions)), $L$ submitting tender offers for $s_i$ shares (Burkart, Gromb, Panunzi, (1998), and noise traders and a market maker (Madhavan (1992- section on dealer markets), Gorton and Kahl (1999-Appendix B), Kyle and Vila (1991), and Kahn and Winton (1998)). The complexity arises because if atomistic shareholders, entrepreneurs or dealers are strategic, prices at time $t = 0$ depend
will bid his or her value at the auctions. The following function relates the demand for shares \( Q_i \) at a given price \( P_i \):

\[
Q_i = K_i \left(1 - F(P_i)\right)
\]  

(C.1)

The price at which the demand for shares equates the supply \( S_i \) can be found by replacing \( Q_i \) in equation C.1 by \( S_i \). The equilibrium price if \( L \) does not bid for shares in firm \( i \) is then:

\[
P_i^* = F^{-1}\left(1 - \frac{S_i}{K_i}\right)
\]

(C.2)

where \( F^{-1}(\bullet) \) denotes the inverse of \( F(x) \), assumed to exist for all \( x \in [0,1] \).

Now, in order for \( L \) to buy \( s_i \) shares in firm \( i \) it has to submit a price such that \((S_i - s_i)\) shares are left in the hands of the atomistic shareholders. The price that \( L \) must submit, given the demand curve C.2 and the condition \( s_i \leq S_i \), is:

\[
P_i(s_i) = F^{-1}\left(1 - \frac{S_i - s_i}{K_i}\right)
\]

(C.3)

on \( L \)'s actions at time \( t = 1, 2 \) and this feedback produces highly nonlinear budget constraints, which were assumed away by the studies mentioned above.
Note that, as expected, the price is increasing in the number of shares that $L$ considers buying and the number of atomistic shareholders that are potential bidders for firm $i$. The price is decreasing in the number of available shares $S_i$. If $\Phi_i$ is the uniform distribution, then equation C.3 reduces to C.4:

$$P_i(s_i) = P_{i,\text{max}} \left( 1 - \frac{S_i - s_i}{K_i} \right) \quad (\text{C.4})$$

The budget constraint 3.3 of the optimization problem of $L$ is then modified to:

$$\sum_{i=1}^{N} (P_{i,0} + k_i s_i) s_i \leq C \quad (\text{C.5})$$

where $P_{i,0} = \frac{P_{i,\text{max}} (K_i - S_i)}{K_i}$, and $k_i = \frac{P_{i,\text{max}}}{K_i}$

As a result of relaxing Assumption 1, $L$ has to consider one additional factor in his choice of an optimal portfolio. This factor is the elasticity of the supply curve for each stock (or equivalently the level of demand of atomistic shareholders in the environment analyzed here). Upward sloping supply curves on average reduce the incentives to hold large blocks in firms with stock prices that react strongly to increased demand or attempts to buy large blocks. The value-to-size ratio has to be modified to account for the different trading costs across firms. The resulting value-to-size ratio is given in C.6:

$$\frac{v_i}{(P_{i,\text{max}} + 0.5k_i S_i)0.5S_i} = \frac{16E\pi_i - 2\rho S_i(1 + 2\pi_i)\sigma^2}{(P_{i,\text{max}} + 0.5k_i S_i)} \quad (\text{C.6})$$
Corollary 3 continues to hold in the extended case with trading costs. The effect of private benefits of control on $L$’s utility is not changed. As we can see, $L$ is now even more likely to choose smaller firms because firm size enters in the denominator of the value-to-size ratio. The trading costs associated with buying a 50% block in each firm affect negatively the probability of a firm being included in $L$’s optimal portfolio. This result is summarized in the following empirical prediction.

Prediction 8. $L$ is more likely to acquire a majority block in firms with less demand from small shareholders $K_i$ and a smaller upper bound on their valuations $P_{i,max}$.

An empirical test of this prediction can be designed in IPO or mass privatization settings. A finding that large investors are more likely to bid for controlling blocks in firms that have less demand from small investors will be consistent with Prediction 8.
The data include all individual bids of each of the 81 PFs in the second auction round of the Bulgarian mass privatization auctions. Each bid contains fund code, firm code, bid price and number of shares asked. A total of 772 bids from 72 funds were submitted for the 180 firms in the sample. In some cases a fund submits multiple bids with different prices for the same firm. Whenever this situation occurs, all bids by the fund are aggregated into a single bid with price equal to the weighted average of the prices of all bids submitted by the fund and size equal to the sum of the sizes of all bids submitted by the fund. Hence, there is one observation per fund-firm in the data to a total of 623 fund-firm observations. Seven bids for one share (5 of those submitted by a single fund) and one bid where, due to a typing error, a fund submitted a bid price that is lower than the reserve price are dropped from the sample. The final sample has 615 bid observations.

A fund may submit bids for more than one firm and correspondingly several funds may decide to bid for the same firm. The distribution of the number of funds that bid for a firm is in Table D–1. In the second auction round, competition between funds is not very intense. In more than 50% of the firms only one single fund or a coalition of two funds submits a bid. The distribution of the number of firms that a fund decided to bid for
can be found in Table D–2. The distribution is quite uniform except several extreme cases of the funds with most capital submitting bids for up to 50 firms.

Firm specific data are attained from the Catalogue of All Firms Offered for Mass Privatization. From there are collected data on fiscal year 1995 total sales, number of employees, and line of business. The same edition contains data on total number of shares, and the percentage of the total number of shares offered for mass privatization. Reserve price, minimum and maximum price at which an investor acquired shares, shares offered, and shares demanded for each firm offered on the second auction round are available in electronic form from the Center for Mass Privatization, Sofia, Bulgaria (CMP). The CMP created 28 regional centers roughly corresponding to the administrative district division of Bulgaria. The final ownership structure of each firm included stakes by each PF and the aggregate amount of shares owned by individuals was also obtained in electronic form from the CMP. Data about the regional center where each firm is located was provided by Rumen Sokolov.

Fund specific variables are collected from the fund prospectuses submitted to the Bulgarian Securities and Exchange Commission. The prospectuses contain information about the city of incorporation of each fund. This information is used to allocate each fund to one of the 28 regional centers created by the Center for Mass Privatization.

Based on the fund prospectuses are outlined three types of funds:

1. Industry-oriented funds – funds that specialize in a single industry or are founded by managers in the industry,

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There are 78 occasions that a PF submits 2 bids with different prices for the same firm, 33 occasions of 3 bids and 10 occasions of more than 3 bids. The maximum number of
2. Regional funds – funds that specialize in a certain geographical region and their founders are from the same region, and

3. Diversified funds - all remaining funds.

Among the 81 privatization funds, 23 are industry oriented or manager sponsored, and 14 are regional funds. The remaining 44 funds announce in their prospectuses that they will form a diversified portfolio of firms without any particular industry or regional specialization. Only 2 of the 44 diversified funds declare that they will form a liquid and well-diversified portfolio of minority stakes. The rest of the “diversified” funds are still planning to spend at least 70% of their vouchers to bid for controlling blocks.

An important variable that influences the likelihood of a fund investing in a firm is a measure of the geographic proximity of the fund and the firm. A simple and conservative way to generate such variable that is implemented in this study is to create a dummy \( \text{REGION} \) equal to 1 if a fund is located in the same regional center as the firm. This variable is conservative because a fund may be 50-60 miles away from a firm and the firm can be still in another regional center. The variable thus measures only close geographical proximity.

In a previous draft another dummy - \( \text{INDUSTRY} \) was created. \( \text{INDUSTRY} \) was equal to 1 if an industry-focused fund submitted a bid for a firm is in the same industry. There is no unified industry classification in Bulgaria equivalent to the SIC system. As a result, the decision that a firm matches the industry specialization of a fund was subjectively made based on information about the main lines of business of the firm.
reported in the *Catalogue of All Firms Offered for Mass Privatization*. The manual creation of the dummy was possible for the 40 firms (2440 observations) included in the sample of the previous draft. The time required to compile the same variable for the 180 firms (12960 observations) in the extended sample of this draft is clearly prohibitive.

The empirical methodology of this paper requires the identification of bids where two or more funds agree before the auction to jointly acquire a block in a firm. This is not a straightforward task because the coalitional contracts are not publicly available. A description of the algorithm used to perform this identification is as follows. First, the ownership data of the 1040 privatized firms immediately after the three auctions is screened to find pairs of funds that have an abnormal number of occasions where the two funds own blocks of shares in the same firm. Then, these potential suspects of coalitions are further explored to find in how many of these occasions the two funds own complementary blocks to a majority block or are the only two owners. These firms are recorded as jointly controlled by the suspect coalitional pair. About 50 pairs jointly control five or more firms and the owner of the large and the owner of the supporting block change across the controlled firms.

Next, the bid data from the second and third auction round are filtered to find occasions where bids at the same price are submitted. The probability of a two bids in a firm to have the same price is very low. If in more than one occasion the same two funds submit bids at the same price, the fund pair is also qualified as a suspect coalition. After the suspect coalitions are identified, manually the 615 bids in the data set are examined.
A bid is classified as a coalitional if both members of a suspect ownership or bidding coalitional pair bid for the same firm and their bids are complementary, and/or submitted at the same or very close price. Additionally, coalitional bids of three funds are identified if these funds are connected through suspect coalitional pairs and their bids are at the same price or complementary to a large block. If more than three coalitional partners bid for a firm, and the sum of their bids is greater than the total amount of available shares, coalitional pairs are identified based on closeness between the partners in terms of number of interactions and same-price bidding occasions.

62 Some identified coalitions were confirmed in conversations with privatization fund managers.
Table D–1: Distribution of the number of funds that decide to bid for a certain firm

This table reports the number of bids received for each of the firms in the sample. 72 Privatization Funds submitted bids for the 180 firms in the sample. Whenever a PF submits more than one bid for the same firm, the bids are aggregated into a single bid.

<table>
<thead>
<tr>
<th>Number of funds that bid for a certain firm</th>
<th>Number of firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>54</td>
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</tr>
<tr>
<td>16</td>
<td>1</td>
</tr>
</tbody>
</table>

Total: 180
Table D–2: Distribution of the number of firms that a fund bid for

This table reports the number of firms that each of the Privatization Funds submitted bids for. 72 Privatization Funds submitted at least one bid for the firms in the sample. The maximum number of firms that a fund bids for is 50.

<table>
<thead>
<tr>
<th>Number of firms that a fund bids for</th>
<th>Number of funds</th>
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</thead>
<tbody>
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</tr>
<tr>
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<td>4</td>
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</tr>
<tr>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>13+</td>
<td>16</td>
</tr>
</tbody>
</table>

Total: 72
Appendix E

DESCRIPTION OF LEE (1983) POLYCHOTOMOUS SELECTION MODEL

For each of the 180 firms in the sample are created 72 observations for the 72 funds that submitted at least one bid. An indicator variable choice1_{ik} is created to be equal to 0 if a fund k does not make a bid for a firm i OR he is not the participant with the largest bid in a minority coalition (coalpct2 ≤ 50%); equal to 1 if a fund k submits a bid for a firm i and the size of the bid as percent of firm capital, bidpct2 < 25%; and equal to 2 if bidpct2 > 25% OR the bid is participating in a majority coalition (coalpct2 > 50%).

At the first stage of the model I estimate a multinomial logit model with a dependent variable choice1 = j, j = 0, 1, 2. After estimating the parameter vector of the model \([\gamma_1, \gamma_2]\), the predicted probabilities for each choice j are computed using the following formulae:

\[
\hat{P}_j = \text{prob}(\text{choice1} = j, j > 0) = \frac{\exp(\hat{\gamma}'_1Z)}{1 + \exp(\hat{\gamma}'_1Z) + \exp(\hat{\gamma}'_2Z)} \quad (\text{E.1})
\]

\[
\hat{P}_0 = \text{prob}(\text{choice1} = 0) = \frac{1}{1 + \exp(\hat{\gamma}'_1Z) + \exp(\hat{\gamma}'_2Z)} \quad (\text{E.2})
\]

where Z is the matrix of left hand side variables of the logit equation.

Then I calculate the terms \(\lambda_{ij}\), which are vectors with a typical element \(\lambda_{ij}\) given by E.3:
\[
\lambda_{ij} = \frac{\phi\left(\Phi^{-1}(P_{ij})\right)}{P_{ij}} 
\]  
(E.3)

Where \(\phi(x)\) and \(\Phi(x)\) are the p.d.f. and the c.d.f. of the standard normal distribution and \(\Phi^{-1}(x)\) denotes the inverse function of \(\Phi(x)\). \(\lambda_j\) are parallel to what Heckman (1976) calls the "inverse of the Mill's ratio". The difference of Lee (1983) is that one further transformation involving \(\Phi^{-1}(x)\) is computed.

After forming \(\lambda_j\), at the second stage, two separate OLS regressions are estimated (one for each \(j > 0\)) of the following form:

\[
\text{Log(bidprice)}_j = \beta_j'X_j + \phi_j'\lambda_j + \epsilon_j 
\]

(E.4)

Where \(X_j\) is a matrix of left-hand side regressors, \(\phi_j = \sigma_j\rho_j\), \(\sigma_j\) is the standard deviation of \(\epsilon_j\), and \(\rho_j\) is the correlation between \(\epsilon_j\) and a transformation of the errors from the logit equation.

Lee (1983) proves that under certain normality assumptions OLS provides consistent estimates of the parameter vector \(\theta_j = [\beta_j, \phi_j]\).
The only complication is that the errors are heteroskedastic and the Variance-Covariance matrix $V_j$ of the parameters $\theta_j$ should be estimated using the expression$^{63}$:

$$V_j = \left(\tilde{X}_j \tilde{X}_j\right)^{-1} \sum_{i=1}^{N_j} \tilde{e}_i^2 \tilde{X}_i \tilde{X}_i + \tilde{X}_j' D * COV * D' \tilde{X}_j \left(\tilde{X}_j' \tilde{X}_j\right)^{-1} \quad (E.5)$$

where $N_j$ is the number of observations in the regression corresponding to choice $j$, $D$ is the matrix of derivatives of $\lambda_j$ with respect to the logit parameters $\gamma$, $COV$ is the variance-covariance matrix of these parameters, and $\tilde{X}_j = [X_j, \lambda_j]$.

After the parameter vectors $\beta_j$ are estimated in (4), the conditional mean prices for each choice are computed as:

$$E(price_j) = \beta_j' \bar{X} \quad (E.6)$$

where $\bar{X}$ is the vector of average values for the continuous variables and equal to 0 or 1 for the dummy variables.

Last, the p-values of the hypothesis that the conditional mean price for choice1 = 2 is greater than the conditional mean price for choice1 = 1 are computed using bootstrapping. The exact details of the bootstrapping are as follows. A sample of size $N = 180*72$ is drawn from the original data set. The two-stage estimates of $\beta_j$ are computed for the drawn sample and then the conditional mean prices are computed using (6). This process is repeated for 1000 drawn samples. At the end, it is counted in how many samples $E(bidprice \mid choice1=2) > E(bidprice \mid choice1 = 1)$. One minus this proportion

$^{63}$ The original expression is found in Lee (1982), who cites White (1980) as the source of the result and proof. Details for the actual implementation into a GAUSS program are available from the author.
gives the p-value of a one-sided test for equality between the conditional bid prices of \( choice_1 = 2 \) and \( choice_1 = 1 \).
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