

Löffler, Clemens; Pfeiffer, Thomas

**Conference Paper**

## Centralized versus Decentralized External Financing, Winner Picking and Corporate Socialism

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und  
Regulierung in einer globalen Wirtschaftsordnung - Session: Firm Organization, No. C14-V2

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Löffler, Clemens; Pfeiffer, Thomas (2013) : Centralized versus Decentralized External Financing, Winner Picking and Corporate Socialism, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Firm Organization, No. C14-V2, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

<https://hdl.handle.net/10419/79902>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Centralized versus Decentralized External Financing, Winner Picking and Corporate Socialism

Clemens Löffler<sup>†</sup>, Thomas Pfeiffer<sup>†</sup>

**Abstract.** Applying the Monti-Klein framework, we examine the optimal financing strategy of a firm that requires funding for individual projects at an imperfect credit market. In particular, we study under which circumstances the firm should raise debt for projects separately (decentralized funding) or jointly (centralized funding) and how this organizational choice affects the selection and resource allocation among projects. We find that it is optimal to decentralize funding when competition at the credit market and the firm's level of equity are both either rather low or rather high. In this case, funding the strongest projects is optimal. For intermediate values of competition and equity, centralized funding is optimal. In this case, bundling strong projects with weak projects can be optimal (corporate socialism). All these funding strategies serve winner picking, i.e. the firm shifts disproportionately more funds to the profitable projects. In contrast to previous literature, winner picking and corporate socialism are not necessarily exclusive; rather, corporate socialism allows winner picking more aggressively.

**Keywords.** Centralized vs. decentralized funding; external financing; corporate socialism; winner picking; imperfect credit market.

---

<sup>†</sup>Department of Business Administration, University of Vienna, Brünner Straße 72, 1210 Vienna, Austria.

# 1 Introduction

Numerous studies have considered the question of how to finance multiple projects. Within this branch of literature usually credit markets are assumed being perfectly competitive (e.g. Leland 2007 for a review on this literature). Nevertheless, empirical evidence documents that credit markets are typically not perfect and that there exists a relation between bank market structure and the cost of credit. While several studies have shown that concentrated banking markets generally lead to higher interest rates and lower supply of loans (e.g. Pagano 1993, Prager and Hannan 1998, Guzman 2000, Cetorelli and Gambera 2001, Beck et al. 2004, Cetorelli and Strahan 2006), considerably less emphasis has been put on the borrower's perspective. This paper addresses this issue by analyzing how a firm should strategically respond and adapt its lending behavior when facing an imperfect credit market.

When a firm requires funding for more than one project at an imperfect credit market, a natural question is how to allocate capital among projects (e.g. Lamont 1997, Shin and Stulz 1998) and whether to centralize or decentralize the external funding of the projects (e.g. Inderst and Müller 2003, Akbel and Schnitzer 2011). While under decentralized funding the firm raises funds for each project separately, under centralized funding the firm bundles the projects and raises funds for the entire bundle. This paper investigates under which circumstances a firm should decentralize or centralize the external funding of projects and how this affects the selection of the projects and the resource allocation among these projects.

We study a firm that is equity restricted and requires funding from an imperfect credit market to conduct two out of three projects: a strong, a moderate, and a weak project. The theoretical analysis on the impact of credit market imperfectness on the equilibrium supply of loans traces back to Monti (1972) and Klein (1971).<sup>1</sup> Based on Cournot competition, the Monti-Klein framework predicts that as fewer banks compete in a market, they decrease the supply of loans which in turn yields higher interest rates. Applying the Monti-Klein frame-

---

<sup>1</sup>For instance, Pagano (1993), Neven and Röller (1999), Guzman (2000), Cetorelli and Peretto (2012) provide applications of the Monti-Klein framework.

work, the firm's cost of capital is determined via Cournot competition between individual banks.<sup>2</sup> Abstracting from organizational issues of the financing process, a well-established result of this branch of literature is that banks require an interest rate plus a markup that is decreasing in the competitiveness of the credit market, i.e. measured as number of banks (e.g. Freixas and Rochet 2008 provide an excellent review).

Treating the organizational form of the financing process and project selection as strategic choice variables in the Monti-Klein framework, our paper shows that these choice variables crucially influence the firm's cost of capital and, thus, the profitability of the firm. Besides the competitiveness of the credit market, another key variable is the firm's level of equity which, allocated effectively among projects, can serve as a strategic substitute to mitigate the banks' market power and, thus, can help restore some market efficiency.

Depending on the competitiveness of the credit market and the firm's level of equity, we find that the firm's optimal financing strategy entails centralized and decentralized funding. The two strategies are quite different. While under centralized funding the firm has to allocate the equity to the individual projects before inquiring for loans, under decentralized funding the firm can allocate all resources, i.e. equity and loans, to the projects after receiving the loan for the whole bundle of projects. Under decentralized funding, it is always optimal for the firm to conduct the strong and the moderate project, while it is never optimal to conduct the weak project. In contrast, centralized funding allows re-allocation of resources more aggressively to the strong project (winner picking as in Stein 1997). By distorting the project selection and conducting the weak project, the firm can reduce the firm's cost of capital for the strong project and increase the firm's value. Engaging in such corporate socialism is consistent with empirical and anecdotal evidence that indicates that firms employ inefficient "socialistic" project selection, i.e. inefficient cross-subsidization of poor projects by stronger ones (e.g. Lamont 1997, Shin and Stulz 1998, Rajan et al. 2000,

---

<sup>2</sup>The Monti-Klein model is arguably the most popular industrial organization approach to banking. The popularity of the Monti-Klein model can be attributed to its potential for empirical applications. Several empirical studies provide evidence that bank behavior in credit markets can be approximated by Cournot competition (e.g. Corvoisier and Gropp 2002, Fernandez de Guevara et al. 2005, Uchida and Tsutsui 2005, Degryse and Ongena 2008).

Ozbas and Scharfstein 2010).

A commonly made explanation for this empirical finding is that intra-company agency conflicts between headquarters and managers within the internal capital market lead to socialistic project selection (e.g. Scharfstein and Stein 2000). Our model provides another rationale by pointing to financing conditions at an imperfect credit market. In contrast to the internal capital market literature, in our model corporate socialism supports the strong project by providing better financing conditions which, in turn, allows the firm to shift disproportionately more funds to the strong project. Such a strategy is typically termed as winner picking (e.g. Stein 1997). By explicitly modeling the project selection process, we find, in contrast to existing literature, that winner picking and corporate socialism are not necessarily exclusive, rather corporate socialism and winner picking can be part of the firm's optimal strategy.<sup>3</sup> In other words, corporate socialism allows winner picking more aggressively.

In our model, the firm always engages in winner picking by shifting funds from the less to the more promising project. Centralized funding allows the firm to engage in winner picking more aggressively. In contrast, the banks prefer decentralized funding since this allows them to discriminate the cost of capital at the expense of the firm. If the market is sufficiently inefficient, the banks can use their market power to force the firm to decentralize the funding. In fact, we find a non-monotonic relationship in that corporate socialism is applied for intermediate values of market competitiveness and equity, while decentralized funding is optimal for high and low values of market competitiveness and equity. Finally, if the credit market is perfect, funding the two strongest projects is always optimal, independent of whether the financing process is centralized or decentralized.

Our research question is closely related to the seminal paper of Inderst and Müller (2003) who investigate a borrower-investor relationship in a Bolton and Scharfstein (1990) contracting environment. They show under which conditions centralized funding dominates

---

<sup>3</sup>Prevailing literature usually considers the resource allocation process for two projects, abstracting from issues of project selection. In such a setup, winner picking and corporate socialism are necessarily mutually exclusive strategies (e.g. Stein 1997, Rajan et al. 2000, Scharfstein and Stein 2000, Brusco and Panunzi 2005, Cestone and Fumagalli 2005, Gautier and Heider 2009).

decentralized funding for two projects (and vice versa). A key difference to our paper is that project selection and, thus, the possibility to engage in corporate socialism is not an issue. Further, consistent with the Monti-Klein framework, we characterize the firm's financing strategy using as key variables the competitiveness of the credit market and the firm's equity.

Our paper is related to the literature on intra-company resource allocation, implying reasons for winner picking and corporate socialism. The empirical literature of internal capital markets predicts that the internal capital allocation process of centralized firms is often inefficient and socialistic (e.g. Lamont 1997, Shin and Stulz 1998, Rajan et al. 2000, Ozbas and Scharfstein 2010). This literature has pointed to agency conflicts as a reason for corporate socialism. The agency problems include the free cash flow problem (Jensen 1986, 1988), managerial risk aversion (Amihud and Lev 1981), rent seeking by divisional managers (Stein 1997, Scharfstein and Stein 2000, Brusco and Panunzi 2005), influence costs (Rajan et al. 2000), and inefficient effort incentives (Bernardo et al. 2006, Gautier and Heider 2009, Wulf 2009).

Our paper is also related to the literature on "self-sabotage," in which a decision-maker sabotages himself in order to engage in a less aggressive strategic interaction with an opponent (e.g. Sappington and Weisman 2005, Arya and Mittendorf 2010). For instance, Arya and Mittendorf (2011) show that a retailer can benefit from devoting resources to less profitable segments in order to mitigate hold-ups from a common supplier. Analyzing the investment behavior in a dynamic duopoly framework, Dawid et al. (2010a) find that in most cases the non-innovating firm benefits when the other firm carries out the innovation. This literature indicates that a firm's strategy depends crucially on the degree of competition. Cestone and Fumagalli (2005) show that, depending on the degree of competition on output markets, a firm channels resources to either more or less profitable units. Dawid et al. (2010b) find that a firm may over- or underinvest in product innovation depending on the degree of competition. Finally, our paper contributes to the industrial organization literature on banking by treating the organizational form of the financing process as a

strategic choice variable (for an overview see Freixas and Rochet 2008).

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes the project selection and investment decisions for decentralized and centralized funding and, then, determines the firm's optimal financing and project selection strategy. Section 4 briefly examines the special case of a monopolistic bank. Section 5 concludes the paper.

## 2 Model

We consider a firm (borrower) who can conduct at most two of three projects,  $P_1$ ,  $P_2$ , and  $P_3$ . The end-of-period cash outflow of project  $P_i$  is given by:  $CF_i(I_i) = (a_i - I_i/2) I_i$ , where  $I_i$  denotes the amount of investment and  $a_i$  denotes the size of the project. Without loss of generality, we assume the following ordering of the projects,  $a_1 > a_2 > a_3$ . Accordingly, we refer to  $P_1$  as "strong project",  $P_2$  as "moderate project" and  $P_3$  as "weak project". The firm holds equity,  $E$ , which can be allocated among the projects,  $\sum_{i=1}^3 E_i = E$ , where  $E_i$  denotes the amount of equity allocated to project  $P_i$ . The firm can take loans,  $L_i$ , from the credit market,  $L_i = I_i - E_i$ . The banks at the credit market are willing to provide funds in exchange for a repayment with an interest rate of  $r_{iB}$ . The firm's cost of capital is given by:  $t_i = 1 + r_{iB}$ .

For our subsequent analysis it is convenient to analyze the investment decisions in terms of terminal values. Given the equity level,  $E_i$ , and the cost of capital,  $t_i$ , the terminal value of project  $P_i$  is given by:

$$CF_i(I_i) - t_i L_i = \left( a_i - \frac{I_i}{2} - t_i \right) I_i + t_i E_i \quad (\text{with } I_i = L_i + E_i).$$

Figure 1 depicts the sequence of events.

- Please insert Figure 1 -

At  $t = 0$ , the firm selects the projects, decides whether it funds the projects in a decentralized or centralized way, and allocates equity to the projects. Under decentralized funding,

the firm raises funds for each project separately. Under centralized funding, the firm bundles the projects and raises funds for the entire bundle. At  $t = 1$ , the firm decides about the amount of investments for the individual projects. At  $t = 2$ , the cash flows get realized and the firm refunds the loans.

To formalize the determination of the cost of capital, we apply the well-known Monti-Klein model with  $N$  banks (Klein 1971, Monti 1972).<sup>4</sup> The Monti-Klein model provides a convenient, often used and also empirically validated framework, i.e. based on Cournot competition banks determine the optimal supply of loans taking into account that their choice affects the attainable interest rate. A key advantage of the Cournot approach is the well-known property that monopoly and (pure) competition are the extremes of a well-understood range of outcomes with respect to the number of banks: monopoly applies for  $N = 1$ , competition for  $N \rightarrow \infty$ , oligopoly in between. The Monti-Klein set-up thus provides a convenient framework for our objective to study how banking market structure affects a firm's financing strategy. For simplicity, we assume that the credit market is solely determined by the firm's demand. The profit function of the  $n$ -th bank financing project  $P_i$  is given by:  $\pi_n = (t_i - 1 - r) \cdot d_{in}(\cdot)$ , where  $r$  denotes the banks' interest rate and  $d_{in}(\cdot)$  denotes bank  $n$ 's supply.

Defining the net size of a project with  $x_i = a_i - 1 - r$ , for  $i = 1, 2, 3$ , we impose the following assumption throughout our analysis.

**Assumption 1**  $x_1 = a_1 - 1 - r > E$ .

Assumption 1 ensures that it is not optimal for the strong project,  $P_1$ , to get funded solely by equity when the banks determine the cost of capital with the interest rate  $r$ . Assumption 1 has two important implications. First, it guarantees that all equity is devoted to finance the projects; no equity remains idle. Second, although we do not consider explicitly the rate of return investors require for equity, Assumption 1 ensures that, in equilibrium, the return on equity is strictly higher than the return on debt.

---

<sup>4</sup>Our results are robust for downward sloping demand functions for loans.



### 3 Results

#### 3.1 Decentralized Funding

We start our analysis with the case that the firm requires decentralized funding for the individual projects. Maximizing the terminal value for project  $P_i$ , i.e.  $CF_i(I_i) - t_i L_i$  with  $I_i = L_i + E_i$ , yields an optimal demand for loans of  $L_i^D(t_i, E_i) = \max\{a_i - t_i - E_i, 0\}$ . Superscript  $D$  indicates decentralized funding. Intuitively, the higher the firm's cost of capital,  $t_i$ , the lower the demanded loan  $L_i$ . The associated maximum terminal value is given by:

$$TV_i^D(t_i, E_i) = \max \left\{ \left( \frac{(a_i - t_i)^2}{2} + t_i E_i \right); \left( a_i E_i - \frac{E_i^2}{2} \right) \right\}. \quad (1)$$

The term,  $(a_i - t_i)^2 / 2$ , represents the terminal value if the project is financed purely by debt. The term,  $t_i E_i$ , represents savings if the firm allocates equity of  $E_i$  to the project. The term,  $(a_i E_i - E_i^2 / 2)$ , denotes the terminal value if the project is financed purely by equity,  $L_i = 0$ .

Applying the Monti-Klein model, the appendix shows that demand for loan,  $L_i^D(t_i, E_i)$ , results in equilibrium cost of capital for the firm (recall:  $x_i = a_i - 1 - r$ ):

$$t_i^D(E_i) = 1 + r + \frac{x_i - E_i}{1 + N}. \quad (2)$$

The cost of capital,  $t_i^D(\cdot)$ , equals one plus the interest rate,  $1 + r$ , plus a markup of  $(x_i - E_i)/(1 + N)$ . The markup is affected by three key factors: net size of the project,  $x_i$ , the amount of equity,  $E_i$ , and the degree of competition at the credit market, i.e. number of banks  $N$ . Since we abstract from organizational issues, all projects independent of their size are frisk-free. Consequently, higher net size of the project increases demand for loans and hence, increase cost of capital. The greater the allocated equity, the smaller the firm's demand for loans and, hence, its willingness to pay. Consequently, the greater the allocated equity,  $E_i$ , the smaller the cost of capital,  $t_i^D$ . The greater the degree of competition at the

credit market, the higher the supply of loans which yields a lower interest rate in equilibrium. Consistent with common observations in Cournot competition, the firm has to pay a lower markup when the market becomes more competitive, i.e. number of banks,  $N$ , increases. For the extreme case of perfect competition,  $N \rightarrow \infty$ , the firm's cost of capital equals one plus the interest rate,  $t_i^D = 1 + r$ .

Substituting the firm's cost of capital,  $t_i^D(E_i)$ , into the terminal value,  $TV_i^D(t_i, E_i)$ , yields a terminal value of  $TV_i^D(E_i) = ((Nx_i + E_i)/(1 + N))^2/2 + E_i(1 + r + (x_i - E_i)/(1 + N))$ .<sup>5</sup> Conducting two arbitrary projects  $P_i$  and  $P_j$ , with  $P_i > P_j$ , yields a total terminal value of

$$TV_{ij}^D(\cdot) = TV_i^D(\cdot) + TV_j^D(\cdot) = \sum_{k=i}^j \left( \frac{1}{2} \left( \frac{Nx_k + E_k}{1 + N} \right)^2 + E_k \left( 1 + r + \frac{x_k - E_k}{1 + N} \right) \right).$$

Solving the first-order conditions with respect to  $E_i$  yields the optimal allocation of equity,

$$E_i = \min \left\{ \frac{E}{2} + \frac{x_i - x_j}{2}, E \right\} \quad \text{and} \quad E_j = (E - E_i).$$

The stronger project  $P_i$  receives more equity with increasing difference between the two projects,  $x_i - x_j$ , amplifying the advantage of the strong project. For  $E \leq \widehat{E}_{ij}^D = x_i - x_j$ , all equity is allocated to the stronger project. Lemma 1 summarizes the equilibrium outcome.

**Lemma 1** *If the firm conducts the two projects,  $P_i$  and  $P_j$ , via decentralized funding, the equilibrium outcome is given by (with  $\widehat{E}_{ij}^D = x_i - x_j$  for  $x_i > x_j$ ):*

---

<sup>5</sup>Calculating return on equity of a single project  $P_i$ ,  $RoE_i^D = TV_i^D/E_i = ((Nx_i + E_i)/(1 + N))^2/2E_i + t_i^D > t_i^D$ , reveals that the return on equity exceeds the firm's cost of capital.

$$\begin{aligned}
E_i^D &= \begin{cases} \frac{E}{2} + \frac{x_i - x_j}{2} & \text{if } E > \widehat{E}_{ij}^D \\ E & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} & E_j^D &= \begin{cases} \frac{E}{2} - \frac{x_i - x_j}{2} & \text{if } E > \widehat{E}_{ij}^D \\ 0 & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} \\
L_i^D &= \begin{cases} N \frac{x_i + x_j - E}{2(1+N)} & \text{if } E > \widehat{E}_{ij}^D \\ N \frac{x_i - E}{(1+N)} & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} & L_j^D &= \begin{cases} N \frac{x_i + x_j - E}{2(1+N)} & \text{if } E > \widehat{E}_{ij}^D \\ N \frac{x_j}{(1+N)} & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} \\
I_i^D &= \begin{cases} x_i - \frac{x_i + x_j - E}{2(1+N)} & \text{if } E > \widehat{E}_{ij}^D \\ x_i - \frac{x_i - E}{1+N} & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} & I_j^D &= \begin{cases} x_j - \frac{x_i + x_j - E}{2(1+N)} & \text{if } E > \widehat{E}_{ij}^D \\ \frac{x_j}{1+N} N & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} \\
t_i^D &= \begin{cases} 1 + r + \frac{x_i + x_j - E}{2(1+N)} & \text{if } E > \widehat{E}_{ij}^D \\ 1 + r + \frac{x_i - E}{1+N} & \text{if } E \leq \widehat{E}_{ij}^D \end{cases} & t_j^D &= \begin{cases} 1 + r + \frac{x_i + x_j - E}{2(1+N)} & \text{if } E > \widehat{E}_{ij}^D \\ 1 + r + \frac{x_j}{1+N} & \text{if } E \leq \widehat{E}_{ij}^D, \end{cases}
\end{aligned}$$

resulting in a maximum total terminal value of

$$TV_{ij}^D = \begin{cases} \frac{1}{2} \sum_{k=i}^j \left( x_k - \frac{x_i + x_j - E}{2(1+N)} \right)^2 + 2E \left( 1 + r + \frac{x_i + x_j - E}{2(1+N)} \right) & \text{if } E > \widehat{E}_{ij}^D \\ \frac{1}{2} \left( \left( \frac{x_i N + E}{1+N} \right)^2 + \left( \frac{x_j N}{1+N} \right)^2 \right) + 2E \left( 1 + r + \frac{x_i - E}{1+N} \right) & \text{if } E \leq \widehat{E}_{ij}^D. \end{cases}$$

It is instructive to study the firm's optimal financing strategy in more detail. If the firm has enough equity,  $E \geq \widehat{E}_{ij}^D$ , it allocates the equity across the two projects so that the costs of capital for both projects do not differ. The reason is that under decentralized funding the banks can discriminate the cost of capital at the expense of the strong project. Equity serves as a strategic instrument to mitigate this problem.<sup>6</sup> Calculating the equilibrium investments for project  $P_k$ , i.e.  $I_k^{DEq} = x_k - (x_k - E/2)/(1+N)$  for  $k = i, j$ , when the firm allocates the equity equally, i.e.  $E_i = E_j$ , we get:  $I_i^D > I_i^{DEq}$  and  $I_j^D < I_j^{DEq}$ . That is, the firm allocates more equity to the stronger project  $P_i$  and invests disproportionately

<sup>6</sup>It is instructive to note that in the absence of strategic interactions, i.e. the cost of capital for each of the two projects is fixed, the firm would allocate the entire equity to the project with the lower cost of capital.

more into the stronger project (henceforth: *winner picking*).<sup>7</sup> Although total investments are identical,  $I_i^D + I_j^D = I_i^{DEq} + I_j^{DEq}$ , winner picking increases the associated total terminal value.

If the firm has not enough equity,  $E < \hat{E}_{ij}^D$ , however, the winner picking strategy is limited. One might suspect that in this case the firm could improve its performance by bundling the two projects. Before we investigate this issue in more detail, we close this section by noting that, consistent with conventional wisdom, it is always optimal for the firm to select the two strongest projects,  $P_1$  and  $P_2$ , but never the weak one,  $P_3$  (e.g. Lang and Stulz 1994, Berger and Ofek 1995, Servaes 1996, Campa and Kedia 2002).<sup>8</sup> We obtain the following result that we state for sake of convenience in a non-technical way.

**Proposition 1** *Under decentralized funding, it is optimal for the firm to conduct always the two strongest projects,  $P_1$  and  $P_2$ , irrespective of the level of equity. The firm always engages in winner picking.*

### 3.2 Centralized Funding

In this section, we investigate whether the firm could improve its performance through centralized funding. Under centralized funding the firm bundles two projects and requires funding for the entire bundle. In particular, we are interested in how centralized funding affects the selection of the individual projects and firm's investment strategy.

Before we study the project selection strategy in more depth, we start our analysis considering an arbitrary bundle of two projects,  $P_i$  and  $P_j$  with  $P_i > P_j$ . Given the cost of capital,  $t_{ij}$ , maximizing the total terminal value  $\sum_{k=i}^j (a_k - I_k/2 - t_{ij}I_k) + t_{ij}E$  with  $I_i + I_j = L + E$ , yields a loan of  $L_{ij}^C(t_{ij}) = \sum_{k=i}^j \max\{a_k - t_{ij}, 0\} - E$ . Superscript  $C$  indicates centralized funding. Assuming an interior solution,  $a_j - t_{ij} > 0$ , we obtain an associated maximum total terminal value of

<sup>7</sup>For instance, Stein (1997) defines winner picking as the practice of actively shifting funds from less promising projects to more promising projects.

<sup>8</sup>The appendix proves that the firm prefers conducting the strong project with debt and equity over conducting the medium project even if the medium project would be realizable purely by equity.

$$TV_{ij}^C = \max \left\{ \frac{(a_i - t_{ij})^2}{2} + \frac{(a_j - t_{ij})^2}{2} + t_{ij}E; \left( a_i E - \frac{E^2}{2} \right) \right\}.$$

In contrast to decentralized funding, the cost of capital is identical for both projects and all equity is assigned to the bundle. The allocation of equity does not play a role. The term,  $(a_i E - E^2/2)$ , denotes the total terminal value if the projects are financed purely by equity,  $L = 0$ . In this case, the firm invests all equity into the stronger project  $i$ .

Now we derive the cost of capital assuming an interior solution,  $a_j - t_{ij} > 0$ . Applying the Monti-Klein model, the appendix shows that demand for loan  $L_{ij}^C(t_{ij}, E)$  results in equilibrium cost of capital for the firm:

$$t_{ij}^C = 1 + r + \frac{x_i + x_j - E}{2(1 + N)}.$$

As before, the markup is decreasing in the number of banks,  $N$ . It is essential for our subsequent analysis that the selection of the individual projects crucially influences the markup,  $(x_i + x_j - E)/(2(1 + N))$ . In fact, the markup is now based on the average of the net size of the two projects less total equity,  $(x_i + x_j - E)/2$ . We will see that the structure of the markup crucially affects the firm's project choice and investment strategy.

An interior solution,  $a_j - t_{ij}^C > 0$ , exists if  $E > \widehat{E}_{ij}^C(N) = x_i - x_j(1 + 2N)$  and the maximum total terminal value is given by:<sup>9</sup>

$$TV_{ij}^C = \frac{1}{2} \sum_{k=i}^j \left( x_k - \frac{x_i + x_j - E}{2(1 + N)} \right)^2 + 2E \left( 1 + r + \frac{x_i + x_j - E}{2(1 + N)} \right).$$

If  $E \leq \widehat{E}_{ij}^C(N)$ , the demand reduces to  $L_{ij}^C(t_{ij}, E) = a_i - t_{ij} - E$ , leading to the same cost of capital as derived under decentralized funding, i.e.  $t_{ij}^C = t_i^D = 1 + r + (x_i - E)/(1 + N)$ . In this case, it is optimal for the firm to allocate the entire equity to the stronger project  $i$ , since the stronger project has a higher marginal impact on terminal value and the allocation  $E_i = E$  reduces the cost of capital for  $P_i$ . Notice that under some circumstances, the banks might be better off limiting the supply of loans to such an extent that it is optimal for the firm to fund only the stronger project  $i$ . However, such a strategy requires coordination to

<sup>9</sup>Calculating the return on equity,  $RoE_{ij}^C = TV_{ij}^C/E = \sum_{k=i}^j (x_k - [x_i + x_j - E]/[2(1 + N)])^2 / (2E) + 2t_{ij}^C > t_{ij}^C$ , reveals that the return on equity exceeds the firm's cost of capital.

collude among banks. Since under Cournot competition collusion is not subgame perfect, banks cannot prevent the firm from practicing centralized funding. However, a monopolist bank,  $N = 1$ , can undertake such a strategy. We analyze this case in Section 4. Before we discuss the selection of the projects in more detail, we summarize the equilibrium outcome for an arbitrary bundle  $(P_i, P_j)$ .

**Lemma 2** *If the firm conducts the two projects,  $P_i$  and  $P_j$ , via centralized funding, the equilibrium outcome is given by (with  $\widehat{E}_{ij}^C(N) = x_i - x_j(1 + 2N)$  for  $x_i > x_j$ ):*

$$\begin{aligned}
E_i^C &= \begin{cases} \text{arbitrary} & \text{if } E > \widehat{E}_{ij}^C(N) \\ E & \text{if } E \leq \widehat{E}_{ij}^C(N) \end{cases} & E_j^C &= \begin{cases} \text{arbitrary} & \text{if } E > \widehat{E}_{ij}^C(N) \\ 0 & \text{if } E \leq \widehat{E}_{ij}^C(N) \end{cases} \\
L_{ij}^C &= \begin{cases} N \frac{x_i + x_j - E}{1 + N} & \text{if } E > \widehat{E}_{ij}^C(N) \\ N \frac{x_i - E}{1 + N} & \text{if } E \leq \widehat{E}_{ij}^C(N) \end{cases} & I_j^C &= \begin{cases} x_j - \frac{x_i + x_j - E}{2(1 + N)} & \text{if } E > \widehat{E}_{ij}^C(N) \\ 0 & \text{if } E \leq \widehat{E}_{ij}^C(N) \end{cases} \\
I_i^C &= \begin{cases} x_i - \frac{x_i + x_j - E}{2(1 + N)} & \text{if } E > \widehat{E}_{ij}^C(N) \\ x_i - \frac{x_i - E}{1 + N} & \text{if } E \leq \widehat{E}_{ij}^C(N) \end{cases} \\
t_{ij}^C &= \begin{cases} 1 + r + \frac{x_i + x_j - E}{2(1 + N)} & \text{if } E > \widehat{E}_{ij}^C(N) \\ 1 + r + \frac{x_i - E}{1 + N} & \text{if } E \leq \widehat{E}_{ij}^C(N), \end{cases}
\end{aligned}$$

resulting in a maximum total terminal value of

$$TV_{ij}^D = \begin{cases} \frac{1}{2} \sum_{k=i}^j \left( x_k - \frac{x_i + x_j - E}{2[1 + N]} \right)^2 + 2E \left( 1 + r + \frac{x_i + x_j - E}{2[1 + N]} \right) & \text{if } E > \widehat{E}_{ij}^C(N) \\ \frac{1}{2} \left( \frac{x_i N + E}{1 + N} \right)^2 + 2E \left( 1 + r + \frac{x_i - E}{1 + N} \right) & \text{if } E \leq \widehat{E}_{ij}^C(N). \end{cases}$$

Similar to decentralized funding, the firm engages in winner picking. As shown in Section 3.1, under decentralized funding, the firm has to allocate the equity across the projects before inquiring for loans. In contrast, under centralized funding the firm allocates the

resources (equity and loans) after receiving the loan for the whole bundle. Allocating the resources after receiving the loan increases the transferable sum. As a consequence, centralized funding improves the financing conditions for the stronger project  $P_i$  and strengthens winner picking compared to decentralized financing, in which the winner picking strategy cannot be implemented perfectly for low equity,  $E < \widehat{E}_{ij}^D$ . In contrast, under centralized funding the winner picking strategy reaches its limit once the weaker project  $P_j$  does not receive funding,  $E < \widehat{E}_{ij}^C(N)$ . Technically, we get:  $I_i^C > I_i^D$  for  $\widehat{E}_{ij}^C(N) < E < \widehat{E}_{ij}^D$ .

Lemma 2 allows us now to analyze the selection of the individual projects. One might suspect that it is optimal to choose the strong and moderate project,  $P_1$  and  $P_2$ , rather than combining the strong and the weak project,  $P_1$  and  $P_3$ . However, comparing the associated maximum total terminal values,

$$TV_{13}^C - TV_{12}^C = (x_2 - x_3) \frac{(x_2 + x_3)(1 + 2N(1 + N)) - 2(1 + 2N)(x_1 - E)}{4(1 + N)^2},$$

reveals that it can be optimal to bundle the strong and the weak project,  $P_1$  and  $P_3$ , if the equity level falls below the cutoff value  $\widehat{E}_{13}^S(N)$ , i.e.

$$TV_{13}^C > TV_{12}^C \quad \text{if} \quad E < \widehat{E}_{13}^S(N) = x_1 - \frac{1 + 2N(1 + N)}{2(1 + 2N)}(x_2 + x_3).$$

Combining the strong and weak project can be interpreted as a kind of *corporate socialism*.<sup>10</sup> The weak project benefits from corporate socialism in that it receives funding, which would never be the case under decentralized funding. In contrast to previous findings, the strong project also benefits since bundling improves the financing conditions of the strong project. From the firm's perspective, corporate socialism is far from being inefficient. In fact, bundling the strong project with the weak project is a thoroughgoing engagement in winner picking, i.e.  $I_1^C(P_1, P_3) > I_1^C(P_1, P_2)$ , although the firm receives less external funding, i.e.  $L_{13}^C < L_{12}^C$ .

The cutoff value  $\widehat{E}_{13}^S(N)$  is increasing in  $x_1$ , but decreasing in  $x_2$  and  $x_3$ . Thus, the greater the difference between the strong project,  $P_1$ , and the other ones, the more likely the firm engages in corporate socialism. Increasing equity reduces the firm's incentive to engage

<sup>10</sup>The superscript  $S$  indicates "(corporate) socialism."

in the weak project  $P_3$ , and, thus, to practice corporate socialism. The rationale is twofold. First, equity increases the share the firm receives from the investments in the projects and reduces the share that the banks receive. Thus, it becomes more important to conduct the most efficient projects. Second, equity reduces demand for loans which increases the competition among banks for the residual demand at the credit market. As competition increases, the markup decreases, which in turn, reduces the firm's incentive to engage in inefficient investments. However, corporate socialism only pays off with the possibility to cross-subsidize the strong project with the weak project. Choosing the moderate and the weak project,  $P_2$  and  $P_3$ , is never optimal, i.e.  $TV_{12}^C > TV_{23}^C$ .

Summing up, we are now in the position to determine the firm's optimal strategy under centralized funding. For sufficiently high levels of equity,  $E > \widehat{E}_{13}^S(N)$ , the demand for loans is relatively low. Thus, it is optimal to conduct the most profitable projects,  $P_1$  and  $P_2$ , instead of reducing the markup by bundling the strong and the weak project,  $P_1$  and  $P_3$  (corporate socialism). For lower amounts of equity,  $E < \widehat{E}_{13}^S(N)$ , credit terms become more important and it is optimal to engage in corporate socialism which improves the financing conditions. Engaging in corporate socialism remains optimal as long as the conditions at the market allow bundling the two projects,  $P_1$  and  $P_3$ , i.e.  $E > \widehat{E}_{13}^C(N)$ .<sup>11</sup> For  $E < \widehat{E}_{13}^C(N)$ , it is again optimal to fund the two strongest projects,  $P_1$  and  $P_2$ .

Corporate socialism can only be an equilibrium candidate if the difference between the moderate and the weak project is sufficiently small, i.e.  $\widehat{E}_{13}^S(N) > \widehat{E}_{13}^C(N)$ , or  $x_2 < x_3[(1 + 6N(1 + N))/(1 + 2N(1 + N))]$  equivalently. To concentrate on an interesting trade-off and to avoid unnecessary case distinctions, we impose throughout the subsequent analysis the following assumption.

**Assumption 2**  $x_2 < x_3 \cdot \frac{1 + 6N(1 + N)}{1 + 2N(1 + N)}$  for  $N > 1$ .

Before we proceed, we summarize the firm's optimal project selection strategy.

**Lemma 3** *Under centralized funding, it is optimal for the firm to conduct*

<sup>11</sup>Similarly if  $E < E_{12}^C(N)$ , it is optimal to conduct only the strong project  $P_1$  and not the moderate project  $P_2$ . In this case, decentralized funding is superior. We will study this issue more in depth in the following section.



- (i) *the strong and the moderate project,  $P_1$  and  $P_2$ , if  $E > \widehat{E}_{13}^S(N)$ ,*
- (ii) *the strong and the weak project,  $P_1$  and  $P_3$ , if  $\widehat{E}_{13}^S(N) > E \geq \widehat{E}_{13}^C(N)$ ,*
- (iii) *the strong and the moderate project,  $P_1$  and  $P_2$ , if  $E \leq \widehat{E}_{13}^C(N)$ ,*

with  $\widehat{E}_{13}^S(N) = x_1 - \frac{1 + 2N(1 + N)}{2(1 + 2N)}(x_2 + x_3) > \widehat{E}_{13}^C(N) = x_1 - x_3(1 + 2N)$ .

In contrast to decentralized funding, the firm's project selection strategy is more complex in that it is not optimal to always select the two strongest projects,  $P_1$  and  $P_2$ . The corporate finance literature has emphasized the importance of equity,  $E$ , and competitiveness of the credit market,  $N$ , as key variables. Lemma 4 demonstrates that the optimality of choosing a particular project bundle does not depend in a monotonic fashion on these two key variables. Before we study whether centralized funding indeed outperforms decentralized funding, we summarize our key finding in a non-technical way.

**Proposition 2** *Under centralized funding, it is optimal for the firm to bundle the two strongest projects,  $P_1$  and  $P_2$ , for high and low levels of equity and to bundle the strong and the weak project (corporate socialism),  $P_1$  and  $P_3$ , for intermediate levels of equity. The firm always engages in winner picking. Winner picking and corporate socialism are not necessarily mutually exclusive, rather corporate socialism induces winner picking more aggressively.*

### 3.3 Centralized versus Decentralized Funding

In this section, we study under which circumstances the firm should centralize or decentralize the funding of the individual projects. We first compare centralized versus decentralized funding for the two strongest projects,  $P_1$  and  $P_2$ . Since under decentralized funding the banks can discriminate the cost of capital at the expense of the firm, centralized funding is (weakly) superior for the firm as long as the conditions at the market allow bundling the two projects  $P_1$  and  $P_2$ , i.e.  $TV_{12}^C > TV_{12}^D$  for  $E > E_{12}^C(N)$  (see Lemma 2). If the firm can bundle the two projects, decentralized funding can at best replicate the outcome of centralized

funding by allocating the equity across the two projects so that it induces the same cost of capital for both projects. As outlined in Lemma 1, the firm can pursue this strategy as long as it has enough equity, i.e.  $TV_{12}^C = TV_{12}^D$  for  $E > \widehat{E}^D$ . For  $E < E_{12}^C(N)$ , bundling is not possible and decentralized funding is superior, i.e.  $TV_{12}^C < TV_{12}^D$  for  $E < E_{12}^C(N)$ . Additionally, as outlined in Lemma 3, the firm can improve centralized funding by engaging in corporate socialism, i.e.  $TV_{13}^C > TV_{12}^C$  for  $\widehat{E}_{13}^S(N) > E \geq \widehat{E}_{13}^C(N)$ . The following Proposition summarizes the firm's optimal strategy that we discuss subsequently.

**Proposition 3** *The firm's optimal financing strategy is given by: the firm*

- (i) *is indifferent between decentralized or centralized funding of the strong and the moderate project,  $P_1$  and  $P_2$ , if  $E > \widehat{E}_{12}^D$ ,*
- (ii) *prefers to centralize the funding of the strong and the moderate project,  $P_1$  and  $P_2$ , if  $\widehat{E}_{12}^D \geq E > \widehat{E}_{13}^S(N)$ ,*
- (iii) *prefers to centralize the funding of the strong and weak project,  $P_1$  and  $P_3$ , if  $\widehat{E}_{13}^S(N) > E \geq \widehat{E}_{13}^C(N)$  (corporate socialism),*
- (iv) *prefers to centralize the funding of the strong and the moderate project,  $P_1$  and  $P_2$ , if  $\widehat{E}_{13}^C(N) \geq E > \widehat{E}_{12}^C(N)$ ,*
- (v) *prefers to decentralize the funding of the strong and the moderate project,  $P_1$  and  $P_2$ , if  $E \leq \widehat{E}_{12}^C(N)$ ,*

*with the relations  $\widehat{E}_{12}^D = x_1 - x_2 > \widehat{E}_{13}^S(N) = x_1 - \frac{1 + 2N(1 + N)}{2(1 + 2N)}(x_2 + x_3) > \widehat{E}_{13}^C(N) = x_1 - x_3(1 + 2N) > \widehat{E}_{12}^C(N) = x_1 - x_2(1 + 2N)$ .*

Two key variables are important in determining the firm's financing strategy: equity,  $E$ , and competitiveness of the credit market,  $N$ . Figure 2 illustrates the firm's optimal strategy as a function of  $E$  and  $N$ .

- Please insert Figure 2 -

For  $E < \widehat{E}_{12}^C(N)$ , decentralized funding of the two strongest projects,  $P_1$  and  $P_2$ , is optimal, since the conditions at the credit market do not allow bundling of particular projects. For  $\widehat{E}_{12}^C(N) < E < \widehat{E}_{13}^C(N)$ , the conditions at the market allow bundling the two strongest projects,  $P_1$  and  $P_2$ , but not the strong and weak project,  $P_1$  and  $P_3$ . Since the equity level is too low to enable the firm to replicate centralized funding of  $P_1$  and  $P_2$  with decentralized funding, centralized funding is superior. For  $\widehat{E}_{13}^C(N) < E < \widehat{E}_{13}^S(N)$ , the market conditions allow bundling  $P_1$  and  $P_3$ . Engaging in such corporate socialism is optimal because it reduces the cost of capital for the strong project. However, since this has the negative effect that the weak project  $P_3$  is conducted, corporate socialism is only optimal if the market is not too competitive. For  $\widehat{E}_{13}^S(N) < E$ , corporate socialism becomes suboptimal, while bundling the two strongest projects becomes optimal. For high equity,  $E > \widehat{E}^D$ , decentralized funding can replicate centralized funding and both forms of funding are optimal.

Since the cutoff value,  $\widehat{E}^D$ , is independent of  $N$ , one might conjecture that centralized funding is preferred for low equity even in the extreme case of a perfect credit market,  $N \rightarrow \infty$ . Calculating the difference of the total terminal values,  $TV_{12}^C - TV_{12}^D$ , shows that the difference converges in the limit to zero,

$$\lim_{N \rightarrow \infty} (TV_{12}^C - TV_{12}^D) = \lim_{N \rightarrow \infty} \frac{(1 + 2N)(x_1 + x_2 - E)^2}{4(1 + N)^2} = 0.$$

Consistent with conventional wisdom, the form of funding does not matter in a perfect credit market, irrespective of the level of equity  $E$ . In particular, it is always optimal to fund the two strongest projects,  $P_1$  and  $P_2$ .

**Corollary** *In the presence of a perfect credit market,  $N \rightarrow \infty$ , the form of funding does not matter. It is always optimal for the firm to fund the two strongest projects,  $P_1$  and  $P_2$ .*

## 4 Extension: Monopolistic Bank

In this section, we study the case of a monopolistic bank. Our previous findings can change for the case that the firm inquires for centralized funding. As mentioned in Section 3.1,

the banks may be better off determining the cost of capital such that the investment of the weaker project becomes non-profitable for the firm. However, as outlined, the banks could not coordinate with each other and establish, in equilibrium, this solution. In contrast, as a monopolist, the bank does not need to coordinate and may have a greater ability to strategically influence the project selection process. However, this section further strengthens our insights, showing that our key insights remain valid.

This section provides a brief sketch how to adapt our previous findings. We start by analyzing the case that the firm wants to fund the projects  $P_i$  and  $P_j$  centrally. The bank has the following two strategies: (i) it can finance both projects providing supply of loans  $L_{ij}^C = (x_i + x_j - E)/2$  which results in equilibrium cost of capital for both projects (as before for  $N = 1$ ),  $t_{ij}^C = 1 + r + (x_i + x_j - E)/4$ , leading to a profit for the bank of  $\pi_{ij}^C = (x_i + x_j - E)^2/8$ ; (ii) it can prevent funding of the weaker project by providing supply of loans just for the amount of  $L_{ij}^M(x_i - E)/2$ .<sup>12</sup> By determining  $L = L_{ij}^M$ , the monopolistic bank ensures that the firm won't invest in the weaker project, resulting in cost of capital as for the decentralized funding case,  $t_{ij}^M = t_i^D = 1 + r + (x_i - E)/2$ , and a profit for the bank of  $\pi_i^M = (x_i - E)^2/4$ . Comparing the two profits, reveals that the bank prefers funding the two projects if equity exceeds the cutoff value  $\widehat{E}_{ij}^M$ , i.e.

$$E > \widehat{E}_{ij}^M = x_i - (1 + \sqrt{2}) x_j. \quad (3)$$

For  $E \leq \widehat{E}_{ij}^M$ , the bank provides sufficient loans to fund the stronger project, leading to cost of capital as for the stronger project under decentralized funding,  $t_{ij}^C = t_i^D$ .<sup>13</sup>

As a consequence, for  $E \leq \widehat{E}_{13}^M$ , the firm bundles the projects  $P_1$  and  $P_2$ , rather than conducting  $P_1$ . Similarly, for  $E \leq \widehat{E}_{12}^M$ , the firm generally refrains from centralized funding and funds the projects in a decentralized manner. Technically,  $\widehat{E}_{ij}^M > \widehat{E}_{ij}^C(1)$ . Similar to

<sup>12</sup>The superscript  $M$  denotes the limit loan strategy of the monopolistic bank.

<sup>13</sup>We show in the appendix that the condition  $E \leq \widehat{E}_{ij}^M$  guarantees that under decentralized funding the cost of capital,  $t_i^D$ , leads to zero demand for the weaker project,  $P_j$ .

the case of  $N$  banks, the firm always conducts the strong and the moderate project,  $P_1$  and  $P_2$ , and corporate socialism is not an issue if  $\widehat{E}_{13}^M(N) < \widehat{E}_{13}^S(N)$ , or  $x_2 > x_3(1 + 6\sqrt{2}/5)$  equivalently. To avoid unnecessary case distinctions, we impose as in our previous section the following assumption.<sup>14</sup>

**Assumption 3**  $x_2 < x_3 \cdot \frac{1 + 6\sqrt{2}}{5}$ .

Summing up, the area in which the firm exercises corporate socialism diminishes from  $\widehat{E}_{13}^C(1) \leq E \leq \widehat{E}_{13}^S(1)$  to  $\widehat{E}_{13}^M \leq E \leq \widehat{E}_{13}^S(1)$ , while the area in which the firm prefers decentralized funding expands from  $E \leq \widehat{E}_{12}^C(1)$  to  $E \leq \widehat{E}_{12}^M(1)$ . In other words, if the bank is a monopolist, its excessive market power limits the firm's possibility to conduct centralized funding. The following Proposition summarizes our finding.

**Proposition 4** *For a monopolized credit market, the firm's optimal financing strategy is given by: the firm*

- (i) *is indifferent between decentralized or centralized funding of the two strongest projects,  $P_1$  and  $P_2$ , if  $E > \widehat{E}_{12}^D$ ,*
- (ii) *prefers to centralize the funding of the two strongest projects,  $P_1$  and  $P_2$ , if  $\widehat{E}^D(1) \geq E > \widehat{E}_{13}^S(1)$ ,*
- (iii) *prefers to centralize the funding of the strong and moderate project,  $P_1$  and  $P_3$ , if  $\widehat{E}_{13}^S(1) \geq E > \widehat{E}_{13}^M$  (corporate socialism),*
- (iv) *prefers to centralize the funding of the two strongest projects,  $P_1$  and  $P_2$ , if  $\widehat{E}_{13}^M \geq E > \widehat{E}_{12}^M$ ,*
- (v) *prefers to decentralize the funding of the two strongest projects,  $P_1$  and  $P_2$ , if  $E \leq \widehat{E}_{12}^M$ ,*

*with the relations  $\widehat{E}_{12}^D = x_1 - x_2 > \widehat{E}_{13}^S(1) = x_1 - \frac{5}{6}(x_2 + x_3) > \widehat{E}_{13}^M = x_1 - (1 + \sqrt{2})x_3 > \widehat{E}_{12}^M = x_1 - (1 + \sqrt{2})x_2$ .*

<sup>14</sup>Notice, Assumption 3 is stricter than Assumption 2, i.e.  $x_2 < x_3 \cdot (12/5)$  for  $N = 1$ . As outlined, the reason is the monopolistic bank's market power in determining the cost of capital.

Importantly, combining our two key results, Propositions 3 and 4, reveals that although corporate socialism is more likely as the credit market becomes less competitive (for  $N > 1$ ), the excessive market power of a monopolist,  $N = 1$ , reverts this result resulting in a non-monotonic relationship.

## 5 Concluding Remarks

Empirical and anecdotal evidence seem to indicate that firms engage in cross-subsidization of weak projects at the expense of strong projects (e.g. Lamont 1997, Shin and Stulz 1998, Rajan et al. 2000, Ozbas and Scharfstein 2010). Previous literature has explained such corporate socialistic behavior by highlighting agency conflicts at the internal capital market (e.g. Stein 1997, Scharfstein and Stein 2000). By pointing to financing conditions at an imperfect credit market, our paper provides another rationale for corporate socialism. Corporate socialism can be part of the optimal financing strategy for a firm that has limited equity and requires funding at an imperfect credit market. Corporate socialism can be an instrument for reducing the firm's cost of capital for the strong project. In contrast to the internal capital market literature, the strong project benefits from corporate socialism since that improves the project's financing conditions and allows the firm to shift disproportionately more funds to the strong project, i.e. winner picking. In fact, corporate socialism allows winner picking more aggressively. In contrast to existing literature, winner picking and corporate socialism are not necessarily mutually exclusive strategies, both can be part of the firm's optimal financing strategy.<sup>15</sup>

Summing up, our model provides several novel predictions concerning a firm's optimal project selection and organizational structure of the financing process using the competitiveness of the credit market and the firm's equity base as key variables. Broadly interpreting our model, we should find centralized funding of strong projects for higher values of market

---

<sup>15</sup>Since the prevailing literature usually considers the resource allocation process for two projects, winner picking and corporate socialism are necessarily mutually exclusive strategies (e.g. Stein 1997, Rajan et al. 2000, Scharfstein and Stein 2000, Brusco and Panunzi 2005, Cestone and Fumagalli 2005, Gautier and Heider 2009).

competitiveness and equity; corporate socialism for intermediate values of market competitiveness and equity; and decentralized funding of strong projects for low values of market competitiveness and equity.

Some of our predictions seem to be in line with previous empirical findings. For instance, previous empirical studies have emphasized the relationship between the level of debt and the organizational structure of the financing process. Consistent with our findings, Barton and Gordon (1988), Taylor and Lowe (1995), Kochhar and Hitt (1998) and Klein and Saldenberg (2010) find that firms have lower debt levels under decentralized funding compared to centralized funding. In our model a key benefit of centralized funding is that this enhances the ability of shifting financial resources to good investments that under decentralized funding would be financially more constrained. This finding coincides to some extent with Billett and Mauer's (2003) empirical finding that resource reallocation to unconstrained segments has no effect on the firm value. Finally, our result that corporate socialism can be optimal is consistent with Rajan et al. (2000) and Billett and Mauer's (2003) finding that subsidies to small segments with poor relative investment opportunities can increase the firm's value. We hasten to add that we do not want to claim that these empirical findings are perfectly in line with our findings. Instead, these studies seem to indicate that forces are at work that might be in line with our findings. Testing our model might be worthwhile.

## 6 Appendix

**Proof of Lemma 1.** The firm's demanded loan,  $L_i^D(t_i, E_i) = a_i - t_i - E_i$ , yields the inverse demand function

$$t_i(L_i^D, E_i) = a_i - E_i - L_i^D, \quad (\text{A1})$$

where  $L_i^D$  is the sum of loans granted by all  $N$  banks,  $L_i^D = \sum_{n=1}^N L_{in}^D$ . The first-order condition of each bank  $n$ 's profit,  $\pi_n(\cdot) = (t_i(L_i^D, E_i) - 1 - r) L_{in}^D$ , with respect to  $L_{in}^D$  yields bank  $n$ 's reaction function,  $L_{in}^D = (a_i - 1 - r - E_i - \sum_{k \in N \setminus n} L_{ik}^D)/2$ . Applying

the symmetry condition for all banks yields each bank's equilibrium supply of  $L_{in}^D(E_i) = (a_i - 1 - r - E_i)/(1 + N)$ . Plugging overall supply,  $L_i^D = N \cdot L_{in}^D(E_i)$ , into (A1) yields the cost of capital (recall:  $x_i = a_i - 1 - r$ )

$$t_i^D(E_i) = 1 + r + \frac{x_i - E_i}{1 + N}.$$

Next, we show that the firm prefers conducting the strong project with debt and equity to conducting the moderate project even if the moderate project would be realizable purely by equity, i.e.  $E > a_2$ . From (1) and (2) we see that the firm prefers to finance the strong project  $P_1$  by debt and equity over financing the same project purely by equity as long as

$$\frac{1}{2} \left( \frac{Nx_1 + E}{1 + N} \right)^2 + E \left( 1 + r + \frac{x_1 - E}{1 + N} \right) > (x_1 + 1 + r) E - \frac{E^2}{2},$$

or  $x_1 > E$  equivalently. Assumption 1 ensures that this inequality is always fulfilled.

Since the firm strictly prefers  $P_1$  over  $P_2$  when both projects are financed purely by equity

$$(x_1 + 1 + r) E - \frac{E^2}{2} > \frac{a_2^2}{2} \quad \text{for } E = a_2,$$

implying that the firm prefers conducting the strong project with debt and equity to conducting the moderate project even if the moderate project would be realizable purely by equity.

**Proof of Lemma 2.** The firm's demanded loan,  $L_{ij}^C(\cdot) = \sum_{k=1}^i \{a_k - t_{ij}\} - E$ , yields the inverse demand function

$$t_{ij}(L_{ij}^C) = \frac{a_i + a_j - E - L_{ij}^C}{2}, \tag{A2}$$

where  $L_{ij}^C$  is the sum of loans granted by all  $N$  banks,  $L_{ij}^C = \sum_{n=1}^N L_{ijn}^C$ . Calculating the first-order condition of each bank  $n$ 's profit,  $\pi_n = (t_{ij}(L_{ij}^C) - 1 - r)L_{ijn}^C$ , with respect to  $L_{ijn}^C$  yields bank  $n$ 's reaction function  $L_{ijn}^C = (a_i + a_j - E - \sum_{k \in N \setminus n} L_{ijk}^C)/2 - 1 - r$ . Applying the symmetry condition for all banks yields each bank's equilibrium supply  $L_{ijn}^C =$



$(a_i + a_j - E - 2(1 + r)) / (1 + N)$ . Plugging overall supply,  $L_{ij}^C = N \cdot L_{ijn}^C$ , into (A2) results in equilibrium cost of capital (recall:  $x_i = a_i - 1 - r$ )

$$t_{ij}^C = 1 + r + \frac{x_i + x_j - E}{2(1 + N)}.$$

**Proof of Proposition 4.** As shown in the text, a monopolist bank prefers funding only the strong project  $P_i$  instead of funding the bundle  $P_i$  and  $P_j$  for  $E < \widehat{E}_{ij}^M = x_i - (1 + \sqrt{2})x_j$ .

We now prove that excluding the weaker project  $P_j$  is feasible by setting  $t_{ij}^C = t_i^D$ . With decentralized funding, overall demand is given by  $(x_i - t_{ij}^C + 1 + r) + (x_j - t_{ij}^C + 1 + r) - E$ , where  $x_k - t_{ij}^C + 1 + r$  is the demand for the respective project. Excluding  $P_j$  requires the determination of cost of capital such that it achieves zero demand for the weaker project,  $x_j - t_{ij}^L + 1 + r = 0$ , and results in the bank's profit of  $\pi_{ij}^L = (x_i - x_j - E)x_j$ . The superscript  $L$  denotes the "limit strategy".

If the limit cost of capital  $t_{ij}^L$  is below the cost of capital for the strong project in the decentralized funding case,  $t_{ij}^L < t_i^D$ , then the bank could increase its profit by raising the cost of capital up to  $t_i^D$  and reaching the profit of the decentralized funding case,  $\pi_i^D = (x_i - E)^2 / 4 > \pi_{ij}^L$ . The reason is that raising cost of capital from  $t_{ij}^L$  to  $t_i^D$  does not change the demand for the weaker project (demand cannot be lower than zero) but allows the bank to charge its optimal cost of capital for the strong project. Foreclosing investments in the weaker project and determining cost of capital with  $t_i^D$  is only possible if  $t_{ij}^L < t_i^D$  or  $E \leq \widehat{E}_{ij}^L = x_i - 2x_j$ .

Finally, contrasting  $\widehat{E}_{ij}^L$  with  $\widehat{E}_{ij}^M$  in (3) reveals that  $\widehat{E}_{ij}^M < \widehat{E}_{ij}^L$ .

## References

- Akbel, B., Schnitzer, M. (2011): Creditor Rights and Debt Allocation within Multinationals, *Journal of Banking and Finance* 35, 1367–1379.
- Amihud, Y., Lev, B. (1981): Risk Reduction as a Managerial Motive for Conglomerate Mergers, *Bell Journal of Economics* 12, 605–617.
- Arya, A., Mittendorf, B. (2011): Supply Chains and Segment Profitability: How Input Pricing Creates a Latent Cross-Segment Subsidy, *Accounting Review* 86(3), 805–824.
- Arya, A., Mittendorf, B. (2010): Input Markets and the Strategic Organization of the Firm, *Foundations and Trends in Accounting* 5(1), 1–97.

- Barton, S., Gordon, P. (1988): Corporate Strategy and Capital Structure, *Strategic Management Journal* 9(6), 623–632.
- Beck, T., Demirguc-Kunt, A., Maksimovic, V. (2004): Bank Competition and Access to Finance: International Evidence, *Journal of Money, Credit and Banking* 36, 627–648.
- Berger, P., Ofek E. (1995): Diversification’s Effect on Firm Value, *Journal of Financial Economics* 37, 39–65.
- Bernardo, A.E., Luo, J., Wang, J.J.D. (2006): A theory of Socialistic Internal Capital Markets, *Journal of Financial Economics* 80, 486–509.
- Billett, M., Mauer, D. (2003): Cross-Subsidies, External Financing Constraints, and the Contribution of the Internal Capital Market to Firm Value, *Review of Financial Studies* 16(4), 1167–1201.
- Bolton, P., Scharfstein, D. (1990): A Theory of Predation Based on Agency Problems in Financial Contracting, *American Economic Review* 80, 93–106.
- Brusco, S., Panunzi, F. (2005): Reallocation of Corporate Resources and Managerial Incentives in Internal Capital Markets, *European Economic Review* 49, 659–681.
- Campa, J., Kedia, S. (2002): Explaining the Diversification Discount, *Journal of Finance* 57, 1731–1762.
- Cestone, G., Fumagalli, C. (2005): The Strategic Impact of Resource Flexibility in Business Groups, *Rand Journal of Economics* 36(1), 193–214.
- Cetorelli, N., Gambera, M. (2001): Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry Data, *Journal of Finance* 56, 617–648.
- Cetorelli, N., Peretto, P. (2012): Credit Quantity and Credit Quality: Bank Competition and Capital Accumulation, *Journal of Economic Theory* 147, 967–998.
- Cetorelli, N., Strahan, P. (2006): Finance as a Barrier to Entry: Bank Competition and Industry Structure in Local U.S. Markets, *Journal of Finance* 61, 437–461.
- Corvoisier, S., Gropp, R. (2002): Bank Concentration and Retail Interest Rates, *Journal of Banking and Finance* 26 (11), 2155–2189.
- Dawid, H., Kopel, M., Kort, P.M. (2010a): Dynamic Strategic Interaction between an Innovating and a Non-innovating Incumbent, *Central European Journal of Operations Research* 18, 453–463.
- Dawid, H., Kopel, M., Kort, P.M. (2010b): Innovation Threats and Strategic Responses in Oligopoly Markets, *Journal of Economic Behavior and Organization* 75, 203–222.
- Degryse, H.A., Ongena, S. (2008): Competition and Regulation in the Banking Sector: A Review of the Empirical Evidence on the Sources of Bank Rents. In: Boot, A., Thakor, A. (eds.), *Handbook of Corporate Finance: Financial Intermediation and Banking*, 483–554, Elsevier/North Holland, Amsterdam.
- Fernández de Guevara, J., Maudos, J., Pérez, F. (2005): Market Power in European Banking Sectors, *Journal of Financial Services Research*, 109–137.
- Freixas, X., Rochet, J-C. (2008): *Microeconomics of Banking*, The MIT Press, Cambridge, Massachusetts, London.
- Gautier, A., Heider, F. (2009): The Benefit and Cost of Winner-Picking: Redistribution

- versus Incentives, *Journal of Institutional and Theoretical Economics* 165, 622–649.
- Guzman, M. (2000): Bank Structure, Capital Accumulation, and Growth: A Simple Macroeconomic Model, *Journal of Economic Theory* 16, 421–455.
- Inderst, R., Müller, H. (2003): Internal versus External Financing: An Optimal Contracting Approach, *Journal of Finance* 58(3), 1033–1062.
- Jensen, M. (1988): Takeovers, their Causes and Consequences, *Journal of Economic Perspectives* 2, 21–48.
- Jensen, M. (1986): Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers, *American Economic Review* 76, 323–329.
- Klein M. (1971): A Theory of the Banking Firm, *Journal of Money, Credit and Banking* 3, 205–218.
- Klein P., Saldenber, M. (2010): Organizational Structure and the Diversification Discount: Evidence from Commercial Banking, *Journal of Industrial Economics* 58(1), 127–155.
- Kochhar R., Hitt M. (1998): Linking Corporate Strategy to Capital Structure: Diversification Strategy, Type and Source of Financing, *Strategic Management Journal* 19(6), 601–610.
- Lamont, O. (1997): Cash Flow and Investment: Evidence From Internal Capital Markets, *Journal of Finance* 52, 83–109.
- Lang, L., Stulz, R. (1994): Tobin’s Q, Corporate Diversification, and Firm Performance, *Journal of Political Economy* 102, 1248–1280.
- Leland, H. (2007): Financial Synergies and the Optimal Scope of the Firm: Implications for Mergers, Spinoffs, and Structured Finance, *Journal of Finance* 62(2), 765–807.
- Monti, M. (1972): Deposit, Credit, and Interest Rate Determination under Alternative Bank Objective Functions. In: Szegö, G.P., Shell, K. (eds.), *Mathematical Methods in Investment and Finance*, 430–454, North-Holland, Amsterdam.
- Neven, D., Röller, L. (1999): An Aggregate Structural Model of Competition in the European Banking Industry, *International Journal of Industrial Organization* 17, 1059–1074.
- Ozbas, O., Scharfstein, D. (2010): Evidence on the Dark Side of Internal Capital Markets, *Review of Financial Studies* 23(2), 581–599.
- Pagano, M. (1993): Financial Markets and Growth. An Overview, *European Economic Review* 37, 613–622.
- Prager, R., Hannan, T. (1998): Do Substantial Horizontal Mergers Generate Significant Price Effects? Evidence from the Banking Industry, *Journal of Industrial Economics* 46(4), 433–452.
- Rajan, R., Servaes, H., Zingales, L. (2000): The Cost of Diversity: The Diversification Discount and Inefficient Investment, *Journal of Finance* 55, 35–80.
- Sappington, D., Weisman, D. (2005): Self-Sabotage, *Journal of Regulatory Economics* 27, 155–175.
- Scharfstein, D., Stein, J. (2000): The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment, *Journal of Finance* 55, 2537–2564.

- Servaes, H. (1996): The Value of Diversification during the Conglomerate Merger Wave, *Journal of Finance* 51, 1201–1225.
- Shin, H., Stulz R. (1998): Are Internal Capital Markets Efficient?, *Quarterly Journal of Economics* 113, 531–553.
- Stein, J. (1997): Internal Capital Markets and the Competition for Corporate Resources, *Journal of Finance* 52, 111–133.
- Taylor P., Lowe J. (1995): A Note on Corporate Strategy and Capital Structure, *Strategic Management Journal* 16(5), 411–414.
- Uchida, H., Tsutsui, Y. (2005): Has Competition in the Japanese Banking Sector Improved? *Journal of Banking and Finance* 29, 419–439.
- Wulf, J. (2009): Influence and Inefficiency in the Internal Capital Market, *Journal of Economic Behavior and Organization* 72, 305–321.

Figure 1: Timeline

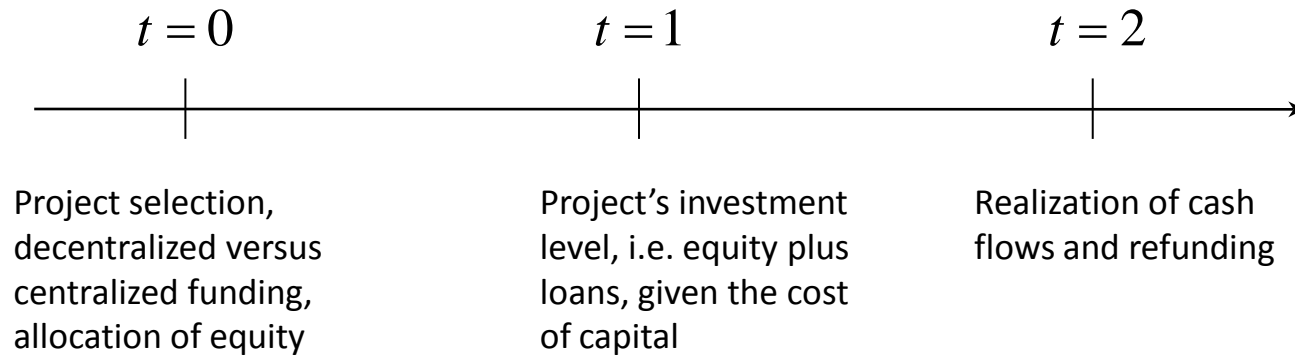
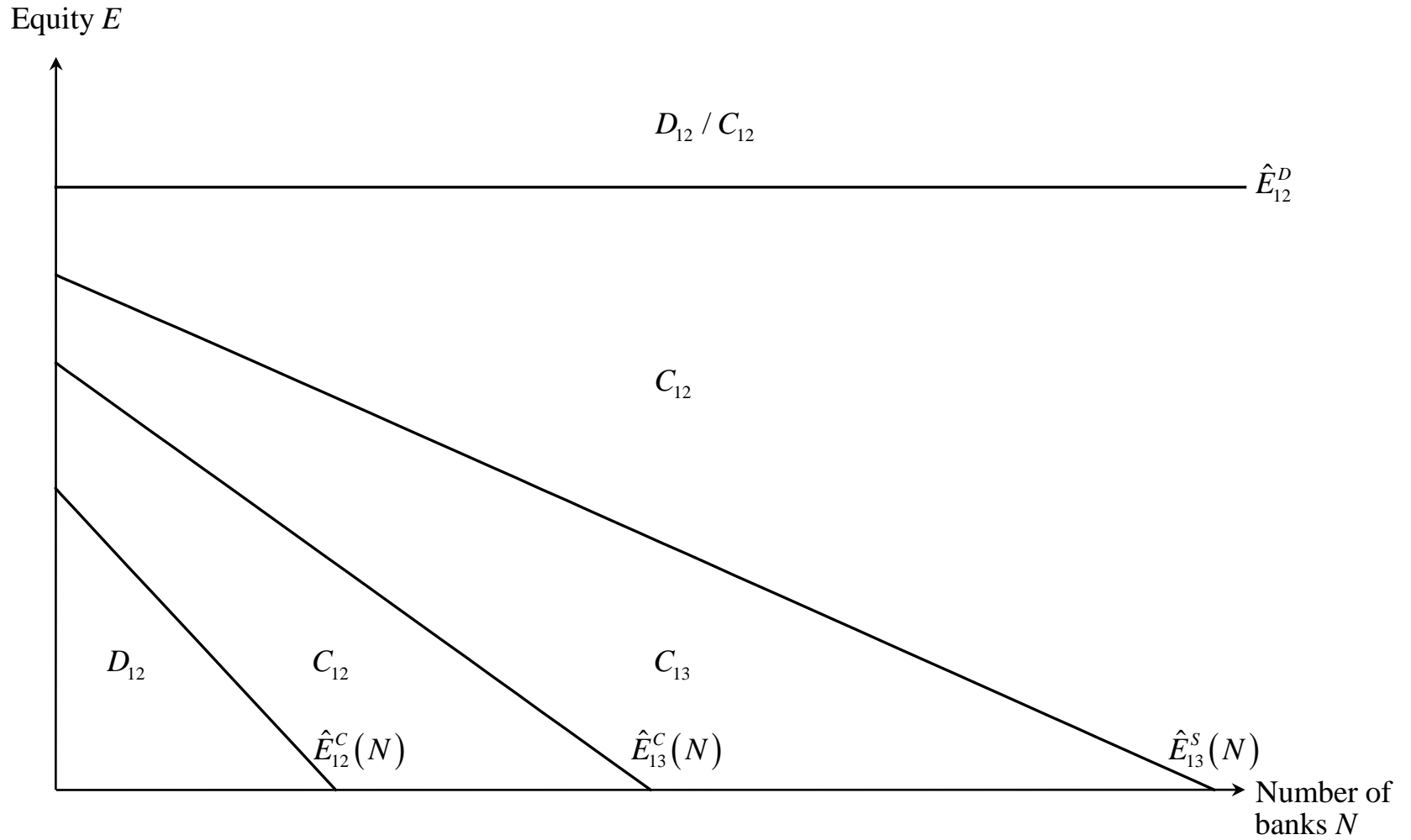


Figure 2: Firm's strategy



$D_{ij}/C_{ij}$ : decentralized/centralized funding of projects  $i$  and  $j$