Objectives of Social Entrepreneurs and Federal Lending Programs, and the Optimal Allocation of External Funds

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1 INTRODUCTION

Economic theory justifies governmental intervention in the market economy by the existence of market failures. Through a well-targeted redistribution the government eliminates such malfunctions and achieves a Pareto-optimal allocation of resources. Standard textbooks on welfare economics pinpoint several causes for market failure, e.g. asymmetric information, natural monopolies, externalities, and public goods.

The prevalence of market failures can be regarded as having both a limiting as well as enhancing effect on entrepreneurship. Intuitively, the malfunction of markets relevant to the formation of a firm complicates or even impedes its implementation, thereby preventing opportunities for value creation from being exploited. A particularly serious failure occurs in credit markets. Innovative and, thus, socially desirable start-ups cannot be launched due to a lack of credit accessibility. The positive externalities caused by the dissemination of new information are not taken into account by private banks when making their financing decisions. Governments across the world have recognized this market failure and, in response, have initiated so-called *federal lending programs*. With external tax revenues at hand, they subsidize interest rates or guarantee private lending. However, governments do not always intervene and market failures remain partly uncorrected. The elimination of these failures constitutes opportunities for entrepreneurs to create social value through a privately organized reallocation of externally raised funds, e.g. donations or grants. Individuals exploiting such opportunities are typically classified *social entrepreneurs*. There is a broad consensus among scientists that the internalization of externalities caused by poverty, i.e. some individuals perceive a disutility caused by low satisfaction levels of others' basic human needs, represents one of the most challenging opportunities for social value creation.

In this dissertation we investigate optimal market failure correction from both the private and governmental perspective. More specifically, we theoretically analyze the optimal allocation of external funds by social entrepreneurs aiming at alleviating poverty, on the one hand, and federal lending programs aiming at securing credit accessibility for innovative start-ups, on the other hand. To this date, both issues have been insufficiently analyzed in the literature. Our main criticism is that the postulated objectives of actors show substantial conceptual weaknesses and often fail to reflect empirical evidence.

Moreover, there is a gap of theoretical work which analyzes optimal federal lending in the presence of information spillovers.

Chapter 2 considers two models of nonprofit entrepreneurial behaviour. In both models, the social entrepreneur observes a number of differently poor individuals who are unable to satisfy a basic human need such as food, shelter, or clothing. The entrepreneur plans to set up a nonprofit organization with the intention of allocating a social good to these needy individuals. Restricted by an exogenously given amount of third-party funds, however, she is unable to serve all applying individuals and, hence, must ration them. Within this setting, our contribution augments the literature on the pricing and rationing behaviour of nonprofit firms.

As a further specification, we characterize the social entrepreneur as an inequity-averse decision maker, who draws a disutility from a deviation of an individual's consumption possibilities from a specific social reference level. By providing needy individuals with the social good, the entrepreneur reduces the inequity and, hence, her own disutility. We thereby build on recent experimental economic research which investigates general social preferences by means of simple distribution games.

In the first model of chapter 2, the entrepreneur rations individuals by charging a uniform user fee for the social good, where she is confronted with the following trade-off: The higher the fee paid by the recipient, the more people in need can be served by the additional revenues. However, by charging a fee, the entrepreneur simultaneously excludes the poorest from consumption. Given that the user fee is insufficient to eliminate the excess demand for the social good completely, it is assumed that applicants are then rationed by non-price allocation mechanisms. Within our theoretical framework, we formally prove the existence of corner and interior solutions. While non-inequity-averse entrepreneurs set the user fee such that no further excess demand occurs, highly inequity-averse entrepreneurs allocate the social good for free and rely exclusively on non-price rationing instruments. In contrast, given moderate inequity aversion, individuals are rationed by both user fees and non-price instruments. Moreover, we find ambiguous reactions of the entrepreneur to a cut in donations. Given a sufficiently low level of status-quo donations, entrepreneurs with relatively high inequity aversion tend to increase the project volume, in contrast to entrepreneurs with relatively low aversion.

In the second model, we modify two assumptions and study the implications for the entrepreneur. First, the entrepreneur not only decides on the quantity and poverty composition of recipients but now also on the quality of the social good. Second, it is assumed that the entrepreneur perfectly price discriminates recipients. As a consequence, the entrepreneur can provide a good of lower quality to many less poor individuals, but she can also supply a good of maximum quality to a small group of the poorest individuals. We find that less inequity-averse entrepreneurs prefer to serve wealthier individuals at high reference quality. In contrast, more inequity-averse entrepreneurs care for the poorest individuals but offer minimum quality. Furthermore, as input costs increase, entrepreneurs with low inequity aversion change the target group, while entrepreneurs with high aversion do not. Additionally, both models demonstrate that the experimentally revealed motive of inequity aversion provides an understanding of how social entrepreneur's benefit, on the one hand, from the quantity and the composition of recipients with regard to their payment ability and, on the other hand, from the service quality.

In chapter 3, we change our perspective and analyze optimal governmental intervention in credit markets in the light of market failures. The chapter evaluates federal lending programs while presuming positive externalities and symmetrically informed market participants. For common objectives of governmental lending institutions we verify that optimal lending structures require the application of the *gap lender principle*. We also show that lending programs can never be self-financing, due to the positive subsidy margin. Within this general framework, we contrast the policies of the US Small Business Administration and the German KfW Mittelstandsbank and show that neither institution features an optimal lending structure.

2 Social Entrepreneurs

2.1 INTRODUCTION

Social entrepreneurship has many facets. Although there exists no standard definition of the term, from an economics perspective social entrepreneurship refers to the creation of new non- and for-profit businesses, organizations, or movements that aim at correcting market failure.[1] For example, social entrepreneurs reduce asymmetric information through protection of consumers when sellers have advantageous knowledge. They reduce monopsonistic power in labour markets by founding trade unions. They provide public goods by enforcing human rights, promoting cultural exchange, or shaping political systems. They internalize externalities by eliminating or preventing environmental damages or by alleviating poverty. The academic literature offers important contributions that help to understand the phenomenon of social entrepreneurship. First, the entrepreneurship literature provides a characterization of the social entrepreneur by pinpointing necessary capabilities and activities. For example, the ideal entrepreneur is able to handle the complexity of social problems, to erect networks through credibility, and to generate followers' commitment to the project. Additionally, the entrepreneur identifies social opportunities, recruits and motivates others, secures the resources that are needed, and overcomes obstacles and challenges.[2] Furthermore, the literature proposes tools and guidelines for entrepreneurial analysis and decision making.[3]

Second, the field of public economics deals with the private provision of public goods. Much attention has been devoted to characterizing donor preferences that theoretically explain why individuals voluntarily contribute to public goods and, hence, why the free-riding problem is of limited empirical significance. The most prominent among these preferences are altruism, warm glow, and prestige.[4]

Third, the literature on industrial organization analyzes observable and optimal behaviour of nonprofit firms in many activities. These include fundraising, generating mission unrelated revenues, pricing, and rationing of needy individuals, to name a few.[5]

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[1] This definition partly reflects statements of Haugh (2005) and Austin et al. (2006).
[2] Compare Waddock and Post (1991), Borins (2000), Thompson et al. (2000), and Thompson (2002).
[3] Compare Dees et al. (2001, 2002), Austin et al. (2006), and Weerawardena and Mort (2006).
[4] Seminal work in this field has been done by Bergstrom et al. (1986), Andreoni (1990), and Harbaugh (1998).
[5] For classic contributions compare Newhouse (1970), Hansmann (1980), Rose-Ackerman (1982), and Weisbrod (1998b).

In this section we argue that, despite the huge body of literature, there exists a gap in explaining social entrepreneurial decision making in the context of poverty alleviation. Specifically, it is not yet fully understood by what objectives the social entrepreneur's allocation of external funds is governed. We begin our analysis by illustrating the magnitude of poverty. We then characterize the nonprofit sector, identify our research questions, survey the related literature, and propose a theoretical framework that features inequity aversion as the key motivation of social entrepreneurs.

Poverty is one of today's most pressing social problems. It constitutes a market failure since altruistic individuals experience a disutility from low consumption levels of poor people.[6] The redistribution of funds from altruistic to poor individuals internalizes positive externalities of consumption and, consequently, achieves Pareto optimality. As an indication of the societal significance of poverty, Mohammad Yunus, who many consider to be the ideal social entrepreneur,[7] was awarded the 2006 Nobel Peace Prize for supplying micro credit to poor people in Bangladesh.

The significance of poverty is also confirmed by empirical studies that quantify the number of poor people in different geographical regions. However, the findings depend crucially on the applied poverty line, for which there is no internationally agreed standard. For example, figure 2.1 shows the results found by Chen and Ravallion (2008). They applied four day-income levels and quantified the percentage of people in the developing world who live below a specific line, subdivided by continents. Accordingly, if people are considered poor who live below $2.50[8] a day, then more than 80 percent of the population in South Asia and Sub-Saharan Africa qualify for this status.

Poverty is even prevalent in industrialized countries. For its quantification, however, much higher poverty lines are applied. For example, in Germany approximately 15 percent of the population earned less than 60 percent of the median income in 2007 and were, hence, considered to be endangered by poverty.[9] A different poverty measure is used in the United States. The United States Census Bureau publishes yearly poverty thresholds whose determinants include the size of family and number of related children under 18 years. For

[6] This definition is based on Hochman and Rodgers (1969).
[7] See, for example, Bornstein (2004) and Martin and Osberg (2007).
[8] The dollar values are based on Purchasing Power Parity (PPP).
[9] See Statistisches Bundesamt (2009).

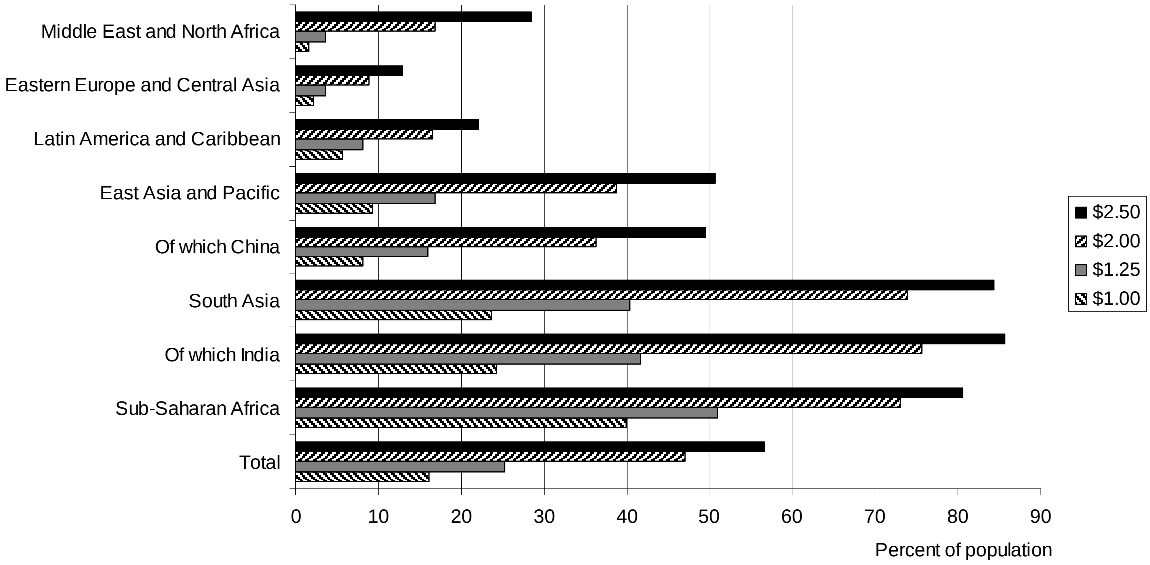

Figure 2.1: Percent of population in developing countries living below $1.00-$2.50 a day in 2005[10]

example, in 2008 this level amounted to $21,834 for a family of two adults and two children.[11] The official poverty rate, i.e. the fraction of people living below the threshold levels, amounted to 13.2 percent.[12] The data clarify that income inequality is not only a problem in the developing world but also in industrialized countries.

Neither is the prevalence of poverty a new phenomenon, nor the privately taken measures against it. Over the past centuries, individuals worldwide have perceived ideas of poverty alleviation by creating nonprofit organizations. Bornstein (2004) argues that St. Francis of Assisi, who founded the Franciscan Order in 1209, can be considered the first social entrepreneur. Since then, the magnitude of the nonprofit sector has continuously increased, with an acceleration over the last decades. In 1929, the sector accounted for approximately 1.2 percent of the US national income, grew to 2.8 percent in 1974,[13] and contributed 5 percent to GDP in 2006.[14] Salamon (1994) argues that a similar development has likewise taken place in other industrialized as well as developing countries around the globe.

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[10] Source: Own illustration.
[11] See U.S. Census Bureau (2010).
[12] See DeNavas-Walt et al. (2009).
[13] See Hansmann (1980).
[14] See Wing et al. (2008).

In contrast to governments, social entrepreneurs do not directly transfer income from wealthy to low income people but allocate specific goods and services that satisfy basic human needs or assist poor individuals to overcome poverty on their own. Related to the satisfaction of basic human needs are organizations that provide food, clothes, shelter, and health services. Additionally, a prominent innovation in this area are micro-insurance schemes which cover basic risks of people in developing countries, e.g. death, life-threatening diseases, accidents, or natural disasters. Products that enable poor individuals to self-improve their financial situation are, for example, education, training, and microcredit. Education or vocational training increase people's knowledge and skills and, thus, enhance their chances of (higher paid) employment. Microcredit institutions lend small loans[15] primarily to poor individuals that start or already run their own business.

Social entrepreneurs cover the costs of producing such goods and services through different sources of finance. Combining the categories identified by Weisbrod (1998a) and Boris and Steuerle (2006) yields the following distinction: Philanthropy (donations and voluntary work), government grants, user fees, investment income, and mission unrelated revenues (income from for-profit activities in other markets). The relevance of each type of income differs between countries and branches. Figure 2.2 shows an international comparison of nonprofit financing between 18 countries.[16] Accordingly, financing by fees (including mission unrelated revenues and investment income) predominates in Mexico (85%). In contrast, the highest fraction of governmental grants is found in Ireland (78%) and philanthropy represents the largest proportion in Romania (36%). There exist diverse explanations for these observations. Salamon and Anheier (1996) argue that private donations are negatively correlated to national tax rates and that public spending is partly historically conditioned. They also assume that in countries where governmental support is relatively low, nonprofits are forced to generate income from other sources, thus implying

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[15] According to Grameen Bank (2008), the institution provided an average micro-enterprise loan of $348.93 in 2008.

[16] The data, taken from Salamon and Anheier (1999), do not include voluntary work. An inclusion would increase the overall fraction of philanthropy to 27 percent and decrease the proportions of fees and governmental spending to 39 and 34 percent, respectively.

a higher fraction of fees and philanthropy.[17] However, empirical evidence from cross-sectoral studies shows mixed results concerning this crowding-out theory.[18]

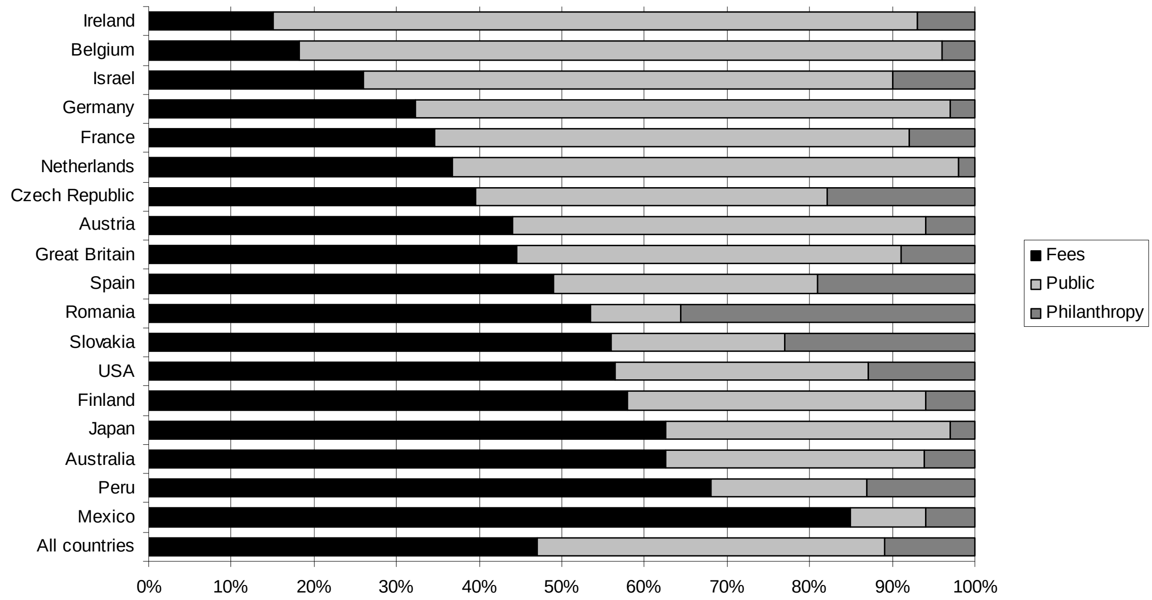

Figure 2.2: Sources of nonprofit income in 1995, by country[19]

Additionally, Salamon and Anheier (1996) examine income structures of different fields of the nonprofit sector. Figure 2.3 depicts the results for ten types of nonprofit activities accross seven countries (France, Germany, Hungary, Italy, Japan, U.K., USA). The comparison shows that fees cover the largest part of costs in business and professional associations (92%). The largest proportion of public spending is observed with health organizations (59%) and the fraction of philanthropy is highest in the field of international development (38%). The figure illustrates that government grants and philanthropy are a major source of finance for organizations that operate in the fields of international development, health, social services, and education. Especially in such fields, a significant fraction of goods and services are designed to alleviate poverty. As an immediate

[17] See Salamon and Anheier (1999).
[18] In contrast to Kingma (1989), both Khanna et al. (1995) and Okten and Weisbrod (2000) do not find evidence that government grants crowd out donations. Instead, there exist positive effects in some industries. Furthermore, they find no significant correlation between program service revenues (fees) and donations.
[19] Source: Own illustration.

consequence, the low payment ability of the targeted poor individuals restricts nonprofit organizations in charging prices and, thus, might explain the low share of fees.[20]

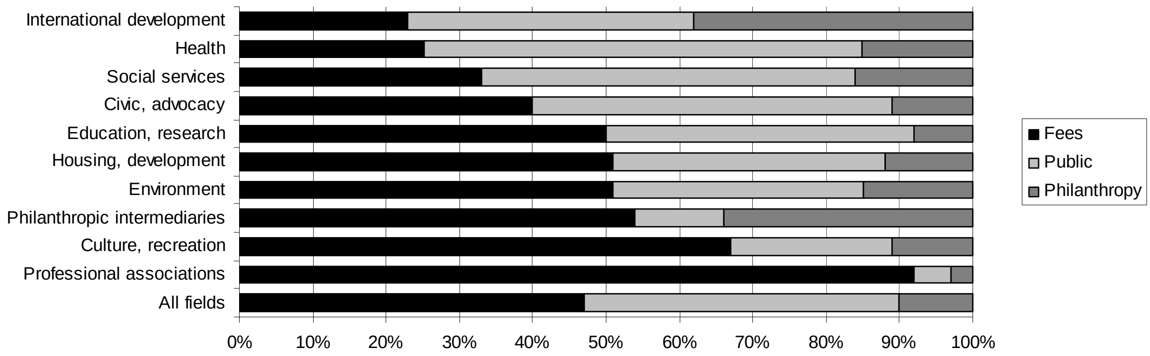

Figure 2.3: Sources of nonprofit income in 1995, by field (7 countries)[21]

Although social entrepreneurs obtain income from various sources, frequently, its total level is insufficient to serve all needy individuals at the desired level. As an indication, a survey on 971 New York food pantries shows that in 1998 34 percent of the pantries were unable to provide all applicants.[22] In such cases, the entrepreneur generally has to choose from two types of rationing: The partial rationing of recipients or the denial of access to some applicants.

Steinberg and Weisbrod (1998) highlight a number of rationing instruments that help the entrepreneur achieve the desired allocation: fees, waiting lists, physical queues, location, eligibility requirements, quality dilution, product bundling, and noncash payments. With regard to poverty reduction, each of the instruments shows distinct benefits and disadvantages. For instance, while user fees exclude individuals with insufficient payment ability, they increase the entrepreneur's income and enable her to serve more needy, although less poor, individuals. In contrast, rationing by waiting benefits the poorest applicants, because their opportunity costs of waiting are lowest, hence inducing them to queue first. However, the recipient's utility of the service can be reduced by the waiting time. As an extreme example, the postponement of a surgery may lead to

[20] Salamon and Anheier (1996) provide a similar explanation.
[21] Source: Own illustration.
[22] See Food for Survival (2000).

long-term damage or even death.[23] Theoretically, waiting time identifies the poorest people indirectly through self-selection. A similar effect occurs with the choice of location. By offering social goods and services in geographic areas where the most needy individuals reside, the entrepreneur minimizes their purchasing costs while enhancing the costs for less needy people outside this area. The use of the instrument is limited by the availability of information about the geographic distribution of incomes.[24] In contrast, a direct identification of targeted individuals is obtained by the formulation of eligibility requirements, e.g. employment status, income, age, family size, gender, religion, etc. However, the applicable mix of criteria and, thus, the targeting success crucially depends on the quantifiability and verification costs of necessary data.

Quality dilution represents a further option for rationing. It reduces the marginal costs of production and, given a constant budget, increases the number of served individuals. Simultaneously, the reduction of the product's quality rations recipients partially since their need-satisfaction level decreases. Alternatively, the entrepreneur could apply noncash payments or product bundling. Both instruments impose additional requirements on the recipient in form of either contributing to the production process (e.g. labour) or purchasing a further good or service. For example, homeless shelters typically offer additional psychological or addiction counselling.

Social entrepreneurs frequently combine the characterized instruments. Food for Survival (2000) reports that New York soup kitchens and food pantries ration applicants through waiting lines and eligibility criteria. Additionally, they bundle their offers with a selection from 28 non-food services like after school programs, budget and credit counselling, job training, or shelter. Social entrepreneurs also price or quality discriminate recipients with regard to specific eligibility criteria. According to the Grameen Bank (2008), the institution imposes an interest rate of twenty percent on self-employed individuals, students pay five percent, and beggars borrow with zero interest. Furthermore, there is evidence that US nonprofit hospitals differentiate the quality (i.e. service intensity) between patient groups.[25]

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[23] Nichols et al. (1971), Lindsay and Feigenbaum (1984), and in a later version Cullis and Jones (1986) provide theoretical analyses of the effects of rationing by waiting.

[24] FAO (2001) discusses practices of geographic targeting in developing countries.

[25] See Friesner and Rosenman (2004).

Moreover, the choice of rationing instruments and their application intensity often differ between social entrepreneurs, even though they operate in the same branch and in the same region. In Germany, food pantries typically allocate their products through applying a mix of user fees and poverty criteria. Rohrmann (2009) reports that the fraction of pantries which formulate eligibility requirements varied between 76.2 percent (2002) and 96 percent (2007). User fees were charged by 65 percent (2002) and 89 percent (2007) of the organizations and differed between 0.50 and 2 Euro per food ration. Theoretically, differences in rationing practices cause different allocations of food, i.e. compositions of recipients. One can expect that pantries that do not charge user fees and demand income verification sheets serve a poorer group of recipients on average than organizations that do not apply eligibility requirements but charge a fee.

Even the rationing of needy individuals through quality dilution is subject to large variations: The provision of shelter ranges from a low-quality emergency stay to a long-term accommodation at market standard; food is supplied on a nonprofit basis by soup kitchens as well as higher quality university cafeterias. Frequently, the choice of quality level follows a specific pattern related to the income of the target group: The good or service provided to the poorest is of significantly lower quality than comparable market offers. According to the World Bank (2003), in low- and middle-income countries services for poor people are often of low quality characterized by inadequately skilled workers, lacking resources, facilities in disrepair etc. More specifically, for micro-insurance schemes addressing the poor in developing countries, a survey by McCord (2001) shows that these insurances' coverage of health risks is very limited.[26] Similar findings are reported for food assistance programs which often supply low-quality food.[27]

These observations lead to the following questions: First, why do social entrepreneurs differ in their choice and application intensity of rationing instruments although they operate within the same social branch? More specifically, with regard to poverty alleviation it is particularly interesting to understand why, as in the case of the German food pantries, some entrepreneurs charge user fees and exclude the poorest applicants

[26] The study pinpoints major exclusions and limitations in the coverage of micro-insurance schemes. Moreover, most of the schemes operate with reimbursement limitations.

[27] Food for Survival (2000) found that the majority of the analysed 971 New York soup kitchens and food pantries offer food that consists of cheap non-perishable goods (rice, pasta, beans, powdered milk, canned foods etc.) while the supply of fresh food is relatively rare.

while others allocate their goods and services for free and ration applicants exclusively through non-price instruments. Second, why do social entrepreneurs provide the poorest individuals with products of relatively low quality? Why do they not alternatively use available income (e.g. donations, grants, or mission unrelated revenues) to lift the product quality to market level at the cost of a lower quantity of recipients?

This chapter addresses both issues by proposing two positive models of social entrepreneurial rationing behavior. For both models, it is assumed that a social entrepreneur discovers a group of individuals who are unable to satisfy a specific basic human need due to their insufficient incomes. The entrepreneur plans to start a nonprofit organization that allocates a need-oriented good. In this context, we examine the conditions of nonprofit allocation patterns. Specifically, the first model (section 2.2) focuses on the entrepreneur's decision on how much to charge for the social good. It is assumed that the price is set uniformly across recipients and the quality of the social good is exogenously given. Furthermore, we assume that individuals vary in poverty, i.e., they feature different abilities to pay for the social good. Hence, pricing involves the following trade-off: The higher the fee paid by the recipient, the more people in need can be served by the additional revenues. But charging a fee means simultaneously to exclude the very poor from consumption. Since exogenous funds of the entrepreneur are considered limited, the model additionally accounts for the possibility of excess demand for the provided good, and it is assumed that, in this case, applicants are rationed by non-price allocation mechanisms, e.g. eligibility criteria or waiting time.

The second model (section 2.3) relaxes two assumptions. It is now assumed that the entrepreneur also chooses the quality level of the social good and perfectly price discriminates individuals. Thus, any allocation is characterized not only by the composition of served individuals according to their income and the quantity of recipients, as in the first model, but also by the quality of the social good. These three dimensions are interrelated due to the constant third-party funds: For example, the higher the quality of the social good, the lower the quantity of served individuals or, alternatively, the richer the recipients.

As indicated in the outline of the models, the analysis of this chapter is constrained to nonprofit entrepreneurship and, hence, excludes entrepreneurs that may pursue social goals but also earn profits in the long run. This restriction reflects the limited ability of for-profit social ventures to alleviate poverty: Given that the payment ability of individuals for a specific social good is lower than the marginal costs of producing it, their provision requires third-party funds. However, as Hansmann (1980) indicates, social ventures with for-profit status are unlikely to obtain donations because, in contrast to nonprofit organizations, they are not subject to the non-distribution constraint, which prohibits entrepreneurs to extract any organizational income for private purpose and, thus, provides donors with a credible signal that funds are used according to the social mission. Consequently, without this constraint, the for-profit social venture is unable to attract donations and is, hence, limited in subsidizing and serving the poorest individuals.

As a further restriction, it is assumed that third-party funds are exogenously given. In other words, donors, volunteers, or governments do not exert any influence on the social entrepreneur's allocation by making their contributions conditional on specific properties of the allocation. The purpose of this dissertation is only to model and analyze the basic patterns of the allocation behavior of social entrepreneurs. In a next step, this model might be augmented by a principal-agent approach, which considers the influence of a lead donor[28] or a government. This extension, however, is left for future research. Nevertheless, the effects of an exogenous variation in donations are analyzed separately in each model of chapter 2. Additionally, the analysis excludes entrepreneurial decisions on the generation of investment income and mission unrelated revenues. Since the maximization calculus of such revenues is independent of their allocation to needy individuals, it is, therefore, assumed that they have been optimized ex-ante. For reasons of simplicity, in the following, the term donations also includes government grants, investment income, and mission unrelated revenues.

In contrast to the previous assumptions, user fees, as the final revenue source for nonprofit entrepreneurs, are differently considered in this chapter. In section 2.2 we assume uniform pricing, whereas the social entrepreneur perfectly price discriminates individuals in section 2.3. Both types of pricing are empirically observable: Typically, soup kitchens, charity shops, or homeless shelters offer their goods or services at uniform

[28] Lead donors typically grant a significant, often the largest, part of the initial financial need of social entrepreneurs. Theoretical analyses of lead donors can be found in Andreoni (1998, 2006).

user fees. Especially in such cases, a detection of reservation prices is prohibitively costly because low-involvement products are sold to a large number of individuals, which excludes price discrimination from further consideration. On the other hand, given that the identification costs of reservation prices are sufficiently low, nonprofits are able to charge sliding-scale fees for different users. Hansmann (1980) as well as Steinberg and Weisbrod (1998) provide numerous examples of such practices, e.g. day care, mental health care, or church membership. Furthermore, in favor of price discrimination, Steinberg and Weisbrod (2005) argue that it is more likely that individuals are willing to reveal their willingness to pay to nonprofit than to for-profit organizations.

After having characterized the basic assumptions concerning the entrepreneurial allocation of external funds, the social entrepreneur's objectives remain to be specified. A survey of the corresponding literature reveals several attempts to characterize the goals of nonprofits which are relevant to the entrepreneurial trade-off between the quantity and the composition of recipients. For example, Steinberg and Weisbrod (2005) characterize pricing and rationing decisions of nonprofit organizations that seek to maximize the weighted sum of the consumers' surpluses. In their model they allow for price discrimination and analyze equilibrium prices in comparison to marginal costs and reservation prices. A similar utility function is used by Feldstein (1972). However, the proposed objectives are inappropriate to analyze the alleviation of poverty or, in other words, the satisfaction of basic human needs, which social entrepreneurs typically consider strongly. Economic theory suggests that individuals satisfy those needs first, provided their budget is sufficiently large. Different reservation prices, as a part of consumer surplus, thus, generally point to different incomes and not to differently intense preferences. It is straight forward to conclude that a given user fee results in a higher surplus for wealthier recipients. Although the nonprofit organization, as analyzed in Steinberg and Weisbrod (2005), might weight wealthier consumers less than poorer, it is unclear why it should consider consumer surplus at all, since this is an inadequate proxy for consumer utility in contexts of poverty. In the extreme case, the provision of individuals without any liquidity to bid for the good or service does not help to fulfill the firm's goal even if the good is allocated to them costlessly. Consequently, they are served last, if at all.

In addition to Steinberg and Weisbrod (2005), there are various other attempts to characterize the objectives of social entrepreneurs and nonprofit organizations, ranging from the maximization of service, budget, and usage to the maximization of the number of users (Steinberg, 1986; Brooks, 2005; Ansari et al., 1996). All these approaches describe a social entrepreneur who extends the project size by charging recipients a fee. However, they do not explain why organizations charge no user fee but simultaneously face congestion.[29]

Furthermore, there exist three different approaches to implement service quality and quantity into the objective function of private nonprofit decision makers. Newhouse (1970) and Rose-Ackerman (1987) follow the established convention that indifference curves between both variables have the "usual" convex shape. Along a second line, Dor and Farley (1996) as well as Friesner and Rosenman (2004) argue in favor of service intensity-adjusted output, where quality (characterized by service intensity) and quantity are multiplicably dependent within the nonprofit's utility function. A third specification is given by Blau and Mocan (2002), who apply a Cobb-Douglas objective function in a child-care setting. However, all approaches lack a profound motivation for the specific interaction of quality and quantity within the decision maker's utility function. Specifically, the intuition of the assumed dependency between the marginal utility of service quality and the absolute level of provided quantity remains unclear.

In this chapter we fill the gap of an adequate utility function by assuming that social entrepreneurs are *inequity averse* in making their decisions. Specifically, the entrepreneur draws negative utility from a deviation of an individual's consumption possibilities from a social reference level. By providing needy individuals with the social good she reduces the inequity and, hence, her own disutility. Our approach thereby builds on recent experimental economic research which investigates general social preferences by means of simple distribution games, e.g. dictator and ultimatum games, where one individual decides on the distribution of an exogenously given amount of money between herself and other players. In their seminal work Fehr and Schmidt (1999) as well as Bolton and Ockenfels (2000) analyze the results of several experiments and conclude that the inequity-

[29] In 1998, all 971 New York food pantries analyzed by Food for Survival (2000) charged no user fees, although 34 percent of the pantries had to turn people away.

aversion motive is able to explain the observed behavior. Exemplarily, Fehr and Schmidt (1999) provide the following definition: “Inequity aversion means that people resist inequitable outcomes; i.e., they are willing to give up some material payoff to move in the direction of more equitable outcomes.”

We apply this motive to our models of social entrepreneurship for two reasons. First, the analyzed distribution games are closely related to the decision context of the social entrepreneur in that an exogenously given amount of third-party funds has to be allocated between different individuals.[30] Second, given that the principle of inequity aversion constitutes a building block in understanding the general fairness preferences of individuals, we can expect it to characterize the motivation of social entrepreneurs, in particular these, whose raison d’être lies in the alleviation of poverty, i.e. mitigation of existing inequitable allocations. However, we prefer a broader definition of inequity aversion than Fehr and Schmidt (1999), who model the preferences of the distributor as self-centered inequity aversion, meaning that she cares about her own payoff relative to the payoff of others. In contrast, we do not restrict the reference outcome to be the entrepreneurs own consumption set but also allow for alternative reference levels, e.g. societal standards.

The results of chapter 2 are as follows. It is shown that the inequity-aversion motive provides a clear understanding of how nonprofits benefit from the quantity and the composition of recipients with regard to their initial consumption endowment, and, in the second model, additionally from service quality. Furthermore, we prove the existence of corner and interior utility maxima which explain various empirically observable allocations. Specifically, given a constant quality of the social good in section 2.2, highly inequity averse entrepreneurs charge no user fees and ration applicants exclusively by non-price allocation mechanisms. In contrast, entrepreneurs with no aversion charge a maximum user fee (no excess demand occurs) and moderately averse entrepreneurs apply both user fees and non-price rationing instruments. Moreover, we find three entrepreneurial reactions to an increase of third-party funds. First, there is a particular level of inequity aversion at which user-fee revenues are reduced to exactly the same amount by

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[30] Although we do not account for efficiency concerns in our model, the distribution game closest to our model specification is analyzed as *treatment R* in Engelmann and Strobel (2004). Here, the decision maker is the wealthiest individual and is likewise not able to extract any rents for herself.

which third-party funds are increased. Hence, the project volume remains unchanged. In contrast, entrepreneurs with a higher poverty aversion react with a reduction of the project volume and entrepreneurs with a lower aversion widen the scope of their service.

Moreover, we show in section 2.3 that target-group and quality patterns, which correspond to the empirical observations mentioned above, can be explained. First, we find that highly inequity-averse entrepreneurs provide the poorest individuals at minimum quality. To date, existing explanations for the low quality of services to the very poor were limited to the role of governmental provision. For example, Glazer and Niskanen (1997) highlight the importance of a poor majority in a public choice setting while Besley and Coate (1991) study governmental measures for redistributing income from the rich to the poor. However, due to the inability of raising taxes, these approaches are inadequate to explain private nonprofit behavior. As a second pattern, we find that weakly inequity-averse entrepreneurs choose to serve the least needy individuals at social reference quality, i.e. maximum quality. Allocations between both extremes occur only for entrepreneurs with moderate aversion. Furthermore, we show that, as input costs increase, entrepreneurs with low inequity aversion change the target group, while entrepreneurs with high aversion do not.

Chapter 2 is organized as follows. In section 2.2.1 we introduce the first model of the entrepreneur's allocation decision which accounts for uniform pricing and a constant quality of the social good. In section 2.2.2 we provide optimality conditions and formally prove the existence of corner solutions (with either maximum or no user fee) and interior utility maxima implying rationing by both user fees and non-price instruments. Section 2.2.3 analyzes a variation in third-party funds. We conclude in section 2.2.4 with a discussion of the model's results. The second model of chapter 2 is introduced in section 2.3.1. It accounts for perfectly discriminated user fees and a variable quality of the social good. Section 2.3.2 analyzes how a variation in donations and input costs impacts the rationing behavior of nonprofits. Again, we conclude in section 2.3.3 with a discussion of these results. Finally, section 2.4 highlights implications for future research in the field of social entrepreneurship.

2.2 RATIONING BY UNIFORM USER FEES AND NON-PRICE ALLOCATION INSTRUMENTS[31]

2.2.1 THE MODEL

Consider a group of individuals unable to satisfy a specific basic human need due to their insufficient incomes. An inequity-averse entrepreneur discovers the deficit and plans to allocate a social good of fixed quality on a nonprofit basis. The constant marginal costs of producing the good are $c \in R_{+}^{*}$. They must be covered by the entrepreneur's income, which might include government grants, private donations or mission unrelated business incomes. We simply subsume those funds under *donations* $D \in R_{+}$ and assume that their total level is exogenously given. In case this level is insufficient to serve all individuals, there is a need to ration applicants. We model two rationing instruments: a uniform user fee as the entrepreneur's decision variable and a non-price allocation mechanism which is automatically applied if further rationing arises. The uniform user fee f, with $f \in [0, f_{max}] \subset R_{+}$ and $f_{max} > c$, mitigates excess demand by excluding individuals with lower reservation prices and enlarging the entrepreneur's budget. The non-price rationing instrument helps the entrepreneur to identify and directly serve only the poorest individuals with the ability to pay the fee.

We do not consider price discrimination for a number of reasons. There are many examples of social businesses typically offering their good at a uniform price. One might hypothesize that those enterprises principally sell low-involvement products to a large number of individuals, such as food providing services or charity shops. Since here a detection of each applicant's income, or rather reservation price, is prohibitively costly, price discrimination is infeasible. Even in cases where several income classes can be defined and different user fees are charged, a further segmentation of heterogeneous subgroups may be desirable but not possible. For example, the allocation of food in a university cafeteria is accompanied by a differentiation of prices between students, members of the university and external visitors. Examination of eligibility is done by student identity cards and service cards. Although students differ in their wealth and poorer

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[31] With little modification, this section is taken from Starke (2010).

students should be subsidized more, a further segmentation according to income would be too costly. In those cases, other rationing instruments, which implicitly allocate the good to the poorest applicants, like queues, are implemented. A perceptible simplification of the model constitutes another reason for analyzing uniform user fees. Subsequently, we argue that all derived results can be likewise shown with a consideration of price discrimination.

The demand for the good is given by $\overline{n}(f)$, with $\overline{n}:[0,f_{max}]\rightarrow R_{+}$, $\overline{n}(f_{max})=0$, $\overline{n}(c)\geq 1$,[32] $\overline{n}(0)<\infty$, $\overline{n}_f := \overline{n}'(f)<0$ and $\overline{n}_{ff} := \overline{n}''(f)>0$. It is important to note that reservation prices are uniquely determined by the individual's ability to pay. Microeconomic theory suggests that a low reservation price is the result of a low income or a weak preference for the good. In contrast, a prerequisite for high reservation prices is a sufficiently large income. However, when basic human needs are concerned, we can assume that individuals will satisfy these first. As a consequence, low reservation fees result from limited payment abilities. Although there might be deviations from this suggested behavior, we postulate a strictly positive correlation between income and payment willingness for the good. The resulting demand curve, therefore, presumes equally intense consumption preferences across all individuals and solely reflects the wealth of applicants.

We further assume that each applicant intends to consume exactly one unit of the good and that each $n\in[0,\overline{n}(0)]$ indexes one individual with a specific disposable income. According to the previous argumentation, the index is negatively correlated to the individual's reservation fee and wealth, respectively. In other words, the higher the index n is, the lower is the individual's income. In particular, the individual $n=0$ is able to pay the prohibitive price f_{max} whereas the poorest individual $n=\overline{n}(0)$ cannot afford to pay anything. At the same time, a specific element n likewise denotes the total quantity of individuals with a higher income than n. Hence, the term $\overline{n}(f)$ provides two important details. It shows the quantity of applicants for the good at a given user fee, and it simultaneously indexes the poorest individual being even able to afford this fee.

[32] The assumption $\overline{n}(c)\geq 1$ simplifies subsequent proofs w.l.o.g..

The social entrepreneur's non-price rationing instrument ensures that only the poorest applicants out of the quantity $\overline{n}(f)$ receive a unit of the good. This requires a direct or indirect detection of reservation prices. Given that the entrepreneur can directly observe reservation prices,[33] she can formulate adequate eligibility criteria and directly exclude wealthier applicants.[34] Even in cases in which the entrepreneur cannot observe them, theory suggests that there are ways to indirectly exclude the wealthiest applicants, e.g. rationing by waiting.[35] Therefore, we forego an explicit modeling of direct and indirect non-price allocation mechanisms by assuming that the entrepreneur has a general non-price tool at hand, which ensures the provision of the poorest applicants. The quantity of the wealthiest individuals being excluded from consumption is denoted by $\underline{n}(f)$, with $\underline{n} \in [0, \overline{n}(f)]$. This term likewise denotes the recipient with the highest income. The combined application of both rationing instruments determines the final quantity of recipients which is given by $\overline{n}(f) - \underline{n}(f)$.

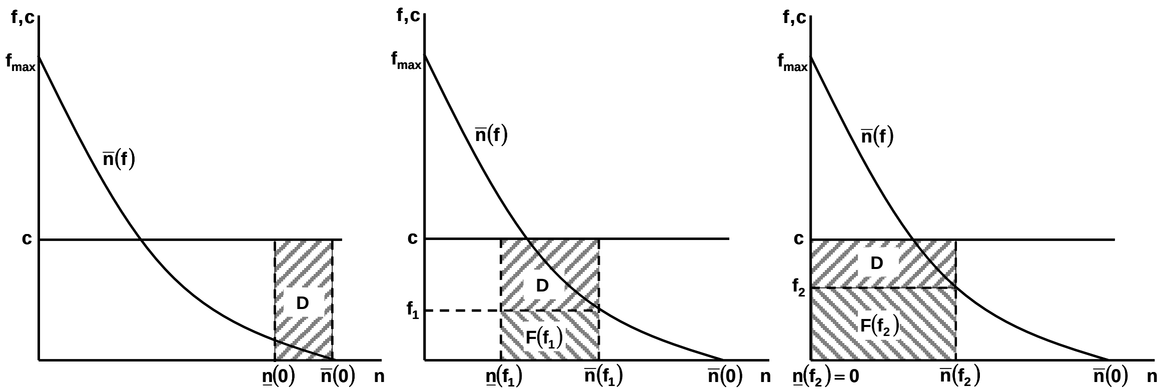
In allocating the good to the needy, the social entrepreneur is restricted by a nonprofit-condition. With $F(f) = f \cdot [\overline{n}(f) - \underline{n}(f)]$ as total user-fee receipts, the constraint is given by

(2.1) $F(f) + D = c \cdot [\overline{n}(f) - \underline{n}(f)]$.

The nonprofit-condition requires the social entrepreneur to spend her total revenues completely on the supply of the good. By rearranging equation (2.1), one obtains $\underline{n}(f) = \overline{n}(f) - [D/(c - f)]$, which shows the endogenous determination of the wealthiest recipient for a given fee f. With the poorest individual able to afford the user fee given by $\overline{n}(f)$, a total of $\overline{n}(f) - \underline{n}(f)$ recipients can be served when the entire donations D are spent to finance the gap between marginal costs and individual contribution ($c - f$).

[33] Steinberg and Weisbrod (2005) give several arguments in favor of this assumption.
[34] Although such practices are supposed to cause so-called targeting costs, we simplify by ignoring them for the following reason: These costs mainly arise due to the identification of suitable income indicators and the screening of individuals. However, since the social entrepreneur must screen all applicants to detect the targeted individuals, targeting costs are independent of the quantity and composition of recipients. Hence, they are fixed costs that simply reduce the amount of donations. A variation in donations is analyzed in section 2.2.3.
[35] Nichols et al. (1971), Lindsay and Feigenbaum (1984) and in a later version Cullis and Jones (1986) provide theoretical analyses of the effects of rationing by waiting.

Figure 2.4 summarizes the impact of the entrepreneur's rationing mechanisms on the market. In panel (a) the entrepreneur allocates the good for free. All considered individuals are willing to purchase the good but, due to the limited donations, only the fraction $\overline{n}(0)-\underline{n}(0)$ is served and the wealthiest $\underline{n}(0)$ individuals are rationed by the non-price instrument. Since the entrepreneur's budget is not enlarged by additional user-fee revenues, the project shows the lowest possible volume. Panel (b) considers the combined use of both rationing instruments. The entrepreneur chooses the user fee f_1 which rations the poorest $\overline{n}(0)-\overline{n}(f_1)$ applicants who are unable to afford the good. Although this fee increases total revenues at first, the budget remains insufficient to provide all applying individuals $([F(f_1)+D]/c<\overline{n}(f_1))$. Consequently, the entrepreneur excludes the wealthiest $\underline{n}(f_1)$ applicants by use of the non-price mechanism. In contrast, panel (c) considers the exclusive supply of the most solvent individuals. The entrepreneur chooses the user fee which maximizes her total revenues, subject to the nonprofit-condition. This ensures that the maximum quantity of applicants is served.



(a) (b) (c)

Figure 2.4: The allocative outcome of rationing by user fees and the non-price instrument.

An additional effect of the nonprofit-constraint is the unique relationship between the user fee and total user-fee revenues. Inserting $F(f)=f\cdot[\overline{n}(f)-\underline{n}(f)]$ into equation (2.1) yields

(2.2) $$F(f)=\frac{f\cdot D}{c-f}.$$

According to this equation, the entrepreneur's choice of f determines her total receipts $F(f)$. Subsequently, we take advantage of this relationship and reverse it. We characterize the social entrepreneur's choice in terms of F instead of the individual fee. At a later stage, this allows for a direct derivation of the project size $F+D$ and, therefore, simplifies the analysis. Rearranging equation (2.2) yields the implicit function

$$(2.3) \qquad \boldsymbol{f}(F) = \frac{c \cdot F}{F+D} \ ,$$

with

$$\boldsymbol{f}_F := \boldsymbol{f}'(F) = \frac{c \cdot D}{(F+D)^2} > 0$$

and

$$\boldsymbol{f}_{FF} := \boldsymbol{f}''(F) = -\frac{2 \cdot c \cdot D}{(F+D)^3} < 0 \ .$$

Employing equation (2.3) into the demand function yields

$$(2.4) \qquad \bar{n}(\boldsymbol{f}(F)) = \bar{n}\left(\frac{c \cdot F}{F+D}\right) \ ,$$

with

$$(2.5) \qquad \bar{n}_F := \bar{n}'(\boldsymbol{f}(F)) = \bar{n}_f \cdot \boldsymbol{f}_F < 0$$

and

$$(2.6) \qquad \bar{n}_{FF} := \bar{n}''(\boldsymbol{f}(F)) = \bar{n}_{ff} \cdot \boldsymbol{f}_F^2 + \bar{n}_f \cdot \boldsymbol{f}_{FF} > 0 \ .$$

As indicated in the introduction, the social entrepreneur is characterized as an inequity-averse person. In this model it suffices to assume that she values the provision to an individual higher, the poorer the person is. This simplification is possible since, due to the constant quality of the social good, the fraction of donations that is allocated to a given recipient is also fixed. Hence, the entrepreneur chooses from allocations that only differ in the composition and quantity of served individuals. For reasons of tractability, in the following, we term this simplified preference form *poverty aversion* to abstract from the more complex specification of inequity aversion used in section 2.3. The most similar characterization to our notion of poverty aversion is given by Nichols et al. (1971, p. 316), who claim that "[…] the poorer a person is, the more willing the public is to provide him […]".

Specifically, the entrepreneur draws a nonnegative level of utility from each allocated unit of the good to a target-group individual, which is characterized by the value function

(2.7) $u(n) = n^{\alpha}$.

Here, the parameter $\alpha \in R_{+}$ determines the constant elasticity of marginal utility $\varepsilon = \alpha - 1$[36] and is likewise a measure for the curvature of the value function. Marginal utility is decreasing with $\alpha \in (0,1)$, constant with $\alpha = 1$, and increasing with $\alpha > 1$. As with the class of Cobb-Douglas utility functions, α characterizes the entrepreneur's preference intensity for recipients with different incomes and will be subsequently interpreted as the entrepreneurial poverty aversion. Specifically, for $\alpha = 0$ the entrepreneur shows no aversion and values the service of each individual the same.[37] However, given a positive level of poverty aversion $(\alpha > 0)$, the entrepreneur obtains a utility surplus from substituting the provision of a lower-income for a higher-income individual. This surplus increases as α grows and becomes infinite with $\alpha \to \infty$. As will be shown later, entrepreneurs with such extreme aversions are predetermined to serve only the poorest target group individuals.

The entrepreneur maximizes her aggregated utility of served individuals by implicitly choosing total user-fee revenues F. According to equation (2.3), this choice uniquely correlates to a specific price level for the good $(f = \boldsymbol{f}(F))$. Individuals who cannot afford f are barred from consumption and, if total revenues are insufficient to serve the remaining applicants (i.e. $(F + D)/c < \overline{n}(\boldsymbol{f}(F))$), the non-price allocation instrument is implemented to exclude the wealthiest individuals $\underline{n}(\boldsymbol{f}(F))$ from consuming the good, because they provide the least value to the social entrepreneur. Finally, only the poorest

[36] The elasticity of marginal utility is defined as $\varepsilon = \frac{du'(n)}{dn} \cdot \frac{n}{u'(n)}$.

[37] With α = 0, the value of serving individual $n = 0$ is not defined. To simplify this case, we set $u(0) = 1$.

applicants with the ability to pay f receive a unit. Consequently, the entrepreneur's maximization problem can be written as[38]

(2.8)
$$\max_F U(F) = \int_{\underline{n}}^{\overline{n}} n^{\alpha} dn$$
$$s.t.\ \underline{n} = \overline{n} - (F + D)/c \ .$$

By employing the rearranged nonprofit-constraint into the utility function, one obtains the following first and second derivative:

(2.9)
$$\frac{dU(F;D)}{dF} = \left(\overline{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \overline{n}_F + \underline{n}^{\alpha} \cdot \frac{1}{c} \gtreqless 0$$

and

(2.10)
$$\frac{d^2U(F;D)}{dF^2} = \left(\overline{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \overline{n}_{FF} + \alpha \cdot \overline{n}_F^2 \cdot \left[\overline{n}^{\alpha-1} - \left(1 - \frac{1}{\overline{n}_F \cdot c}\right) \cdot \underline{n}^{\alpha-1}\right] + \frac{\alpha}{c} \cdot \underline{n}^{\alpha-1} \cdot \left(\overline{n}_F - \frac{1}{c}\right) \gtreqless 0 \cdot$$

In the next section we prove the possibility of interior utility maxima and corner solutions.

2.2.2 INTERIOR AND CORNER SOLUTIONS

It is important to keep in mind that the entrepreneur can solely enhance her user-fee revenues through an increase of the user-fee level. The unique quantitative relationship between both variables is given by equation (2.2). Although, this equation comprises additional parameters like the amount of donations or the marginal costs of producing the good as well, they are outside the entrepreneur's scope of influence.

We define the following terms. The optimal level of user-fee revenues will be denoted by F^* and the corresponding user fee by f^*. Furthermore, the maximum user-fee revenues will be denoted by F_{max} which is achieved if the entrepreneur's total income suffices to serve all applying needy. Consequently, $\underline{n} = 0$ and F_{max} fulfills the reduced nonprofit-condition (2.1), i.e.

[38] In the maximization problem and subsequent derivations we simplify the explicit notation $\overline{n}(\ell(F))$ and $\underline{n}(\ell(F))$ by use of $\overline{n}$ and $\underline{n}$.

(2.11) $F_{max} + D = c \cdot \bar{n}(\ell(F_{max}))$.

The entrepreneur's mission is achieved best if all individuals of the target group receive one unit of the good. Hence, a costless provision of beneficiaries is required to avoid a rationing of the poorest individuals. Consequently, the production costs of serving the total target group must be completely covered by donations $(D = \bar{n}(0) \cdot c)$. If donations are not available $(D = 0)$, i.e. the applicants' provision is not externally subsidized, the entrepreneur must refrain from the allocation of the good or, alternatively, serve only those individuals who can afford a cost covering user fee $(f = c)$. The dominance of the second option results from value function (2.7). Since any individual of the target group is assigned a nonnegative value $u(n)$, serving only individuals who can afford the good is preferred to non-provision. Total utility (equation (2.8)) is maximized if all applicants who show a payment ability of at least marginal production costs c are served.

Proposition 2.1. Given $D = 0$, the entrepreneur charges a cost covering user fee $\left(f^* = c\right)$ and serves all needy individuals that can afford to apply, $\bar{n}(c)$.

Proof. With $D = 0$, equation (2.3) yields $\ell(F) = c$. Substituting c for $\ell(F)$ in utility function (2.8) and differentiating with respect to F yields $dU(F;0)/dF = \underline{n}^{\alpha} \cdot (1/c) \geq 0$. Consequently, utility is maximized if all $\bar{n}(c)$ applicants are served. **Q.e.d.**

Now, suppose total donations amount to $\tilde{D} \in (0, \bar{n}(0) \cdot c)$, which suffices to initially serve $\tilde{D}/c < \bar{n}(0)$ applicants. Confronted with the resulting excess demand, the social entrepreneur determines her optimal level of user-fee revenues, which, again, is a choice of how many individuals are excluded by the user fee and how many are rationed by the non-price rationing instrument. According to the first derivative (2.9), the increase of user-fee receipts F is accompanied by two effects on the entrepreneur's utility. First, there is a non-positive *crowding-out effect* $\left(\bar{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \bar{n}_F \leq 0$. Let revenues and, equivalently, the quantity of recipients be constant, then an increase in user fees cuts off the poorest from consumption and shifts the released units of the good to wealthier individuals. This effect is utility neutral only if the entrepreneur values all individuals equally. In contrast, given a positive level of poverty aversion α, the substitution of wealthier for poorer beneficiaries decreases her utility. The second term of equation (2.9) denotes the nonnegative *revenue effect* $\underline{n}^{\alpha} \cdot (1/c) \geq 0$. The additional user-fee receipts enable the entrepreneur to extend the quantity of recipients, which increases her utility. The value of the revenue effect becomes zero if all applicants are served.

Dependent on the entrepreneur's poverty aversion, both interior and corner solutions are possible. If the crowding-out effect dominates the revenue effect for any level of user-fee revenues, the entrepreneur allocates the good for free $\left(F^* = 0\right)$ and rations applicants by the non-price instrument. Intuitively, the higher the poverty aversion is, the less the entrepreneur is willing to substitute wealthier for poorer individuals and the sooner she foregoes charging a user fee. On the other hand, if the revenue effect exceeds the crowding-out effect independent of the level of user-fee receipts, the entrepreneur generates maximum revenues $\left(F^* = F_{max}\right)$ and serves the maximum quantity of beneficiaries. This corner solution arises for a non-poverty averse entrepreneur for whom applicants are perfect substitutes. Finally, there are interior utility maxima for moderate levels of poverty aversion $\left(0 < F^* < F_{max}\right)$. The value of the initially dominant revenue effect is offset by the crowding-out effect at some positive level of user-fee revenues and overcompensated for higher levels. Consequently, as exemplarily depicted in figure 2.4 (b), the poorest applicants are rationed by the user fee and the wealthiest applicants are excluded by the non-price allocation mechanism. In the next three propositions, we show the possibility of interior and corner solutions.

Proposition 2.2. Given $D \in (0, c \cdot \overline{n}(0))$, there exists a finite poverty aversion level $\overline{\alpha}$ such that for all $\alpha \geq \overline{\alpha}$, $F^* = 0$.

Proof. For notational clarity, we temporarily expand the term $U(F;D)$ to $U(F;D,\alpha)$ to emphasize the influence of the entrepreneur's poverty aversion. Let $D \in (0, c \cdot \overline{n}(0))$. Since $\overline{n}_F < 0$ and $\overline{n} > \underline{n}$, there exists a finite $\overline{\alpha} \geq \left[ln\left(1 - \frac{1}{\overline{n}_F \cdot c}\right) \Big/ (ln\,\overline{n} - ln\,\underline{n}) \right]$ for all $F \in [0, F_{max}]$ which implies $-\left(\overline{n}^{\overline{\alpha}} - \underline{n}^{\overline{\alpha}}\right) \cdot \overline{n}_F \geq \underline{n}^{\overline{\alpha}} \cdot (1/c)$. Since the revenue effect does not exceed the crowding-out effect for all levels of user-fee revenues, an entrepreneur with the poverty aversion level $\overline{\alpha}$ chooses $F^* = 0$. Since, by definition, $\overline{n}(c) \geq 1$, $\frac{\partial^2 U(F;D,\overline{\alpha})}{\partial F \partial \alpha} = ln\,\overline{n} \cdot \overline{n}^{\overline{\alpha}} \cdot \overline{n}_F - ln\,\underline{n} \cdot \underline{n}^{\overline{\alpha}} \cdot \left(\overline{n}_F - \frac{1}{c}\right) < 0$ and the first derivative (2.9) is negative, given $F \in [0, F_{max}]$ and $\alpha > \overline{\alpha}$. Consequently, $F^* = 0$. **Q.e.d.**

According to proposition 2.2, any social entrepreneur with a level of poverty aversion equal or higher than a specific value $\overline{\alpha}$ does not wish to charge user fees.[39] For those entrepreneurs the first derivative of the utility function (equation (2.9)) is non-positive. This result is mainly driven by the utility difference between the poorest and the wealthiest marginal recipient, which is a component of the crowding-out effect. Since this difference increases with the entrepreneur's poverty aversion, there exists a specific level, above which the crowding-out effect dominates the revenue effect for all levels of user-fee revenues. Consequently, utility is maximized if the entrepreneur refrains from charging user fees and finances its allocation exclusively by donations.

Proposition 2.3. Given $D \in (0, c \cdot \overline{n}(0))$, there exists a positive poverty aversion level $\hat{\alpha} \leq \overline{\alpha}$ such that for all $\alpha < \hat{\alpha}$, $F^* > 0$.

Proof. Let $D \in (0, c \cdot \overline{n}(0))$ and $\hat{\alpha} = \left[ln\left(1 - \frac{1}{\overline{n}_F \cdot c}\right) \Big/ (ln\,\overline{n} - ln\,\underline{n}) \right]\Big|_{F=0} > 0$. $\alpha < \hat{\alpha}$ then implies $\left[\underline{n}^{\alpha} \cdot (1/c) > -\left(\overline{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \overline{n}_F\right]\Big|_{F=0}$, which is a necessary condition for the existence of a utility maximum with $F^* > 0$. **Q.e.d.**[40]

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[39] The same results arise with a consideration of price discrimination. Intuitively, since reservation prices, to some extent, are lower than marginal costs, recipients must be subsidized by donations or 'cash cows' (Steinberg and Weisbrod, 2005). If revenues are insufficient to allocate the good to all applicants, the entrepreneur must ration them and decide who and how many needy will be served. If she chooses the poorest applicants, this requires the highest individual subsidies and benefits the lowest quantity of recipients. In contrast, the maximum quantity of recipients follows from serving the wealthiest applicants. It is important to note that a change of quantity causes the same qualitative effects on the entrepreneur's utility: a non-positive crowding-out effect and a nonnegative revenue effect. For the same reason, interior and corner solutions are possible and depend on the entrepreneur's level of poverty aversion.

[40] The set $[0, \hat{\alpha})$ is far from being complete. One can show that there are global utility maxima for higher levels of poverty aversion which start with a dominant crowding-out effect for the first unit of user fees $\left[\underline{n}^{\alpha} \cdot (1/c) \leq -\left[\overline{n}(F)^{\alpha} - \underline{n}^{\alpha}\right] \cdot \overline{n}'(F)\right]\Big|_{F=0}$. The increase of fees initially decreases utility to some minimum before the revenue effect overcompensates the utility loss and induces a global maximum. Since all important results can be proved without an extension to these special cases, we simplify the analysis by ignoring them.

Proposition 2.3 claims that any social entrepreneur with sufficiently low poverty aversion chooses a positive level of user fees. Again, consider the entrepreneur's marginal utility (equation (2.9)) for the first unit of user-fee revenues. In line with the intuition of the previous proposition, with a poverty aversion below a specific level $\hat{\alpha}$ the utility difference between the poorest and the wealthiest marginal recipient and, hence, the crowding-out effect are sufficiently low. Consequently, the entrepreneur's marginal utility is positive and user fees are charged.

Proposition 2.4. Given $D \in (0, c \cdot \overline{n}(0))$, there exists a strict corner solution with $F^* = F_{max}$, if, and only if, $\alpha = 0$.

Proof. Consider the first derivative of the utility function (2.9). Let $D \in (0, c \cdot \overline{n}(0))$ and $\alpha > 0$. Since $\overline{n} > 0$ and, by definition, $\overline{n}_F < 0$, $\lim_{F \to F_{max}} \left(\overline{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \overline{n}_F < 0$ and $\lim_{F \to F_{max}} \underline{n}^{\alpha} \cdot (1/c) = 0$. Hence, $\lim_{F \to F_{max}} dU(F;D)/dF < 0$ and $F^* < F_{max}$. In contrast, let $\alpha = 0$. Since, $\left(\overline{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \overline{n}_F = 0$ and $\underline{n}^{\alpha} \cdot (1/c) \geq 0$, $dU(F;D)/dF \geq 0$ for all $F \in [0, F_{max}]$ and $F^* = F_{max}$. **Q.e.d.**

According to proposition 2.4, only non-poverty-averse entrepreneurs choose the corner solution with the maximum of user-fee revenues F_{max}. For a deeper understanding of the result consider again the entrepreneur's marginal utility (equation (2.9)). Given a positive level of poverty aversion, the crowding-out effect is strictly negative, since the substitution of lower-valued wealthier for higher-valued poorer individuals always entails a loss in utility. Concerning the revenue effect, on the other hand, the additional utility the entrepreneur gains from enlarging the group of recipients through additional user-fee receipts approaches zero since the wealthiest recipient $(n = 0)$ is of no value to the entrepreneur. As a result, there is a level of user-fee revenues at which both effects offset each other and, hence, $F^* < F_{max}$. In contrast, non-poverty-averse entrepreneurs assign equal value to each individual, which implies that there is no crowding-out effect. The marginal utility is characterized by a nonnegative revenue effect implying that the maximum user-fee revenues F_{max} are chosen.

The graphical characterization of propositions 2.2-2.4 is presented in figure 2.5. It contrasts total revenues $F+D$, also considered as *project volume,* and the entrepreneur's overall utility $U(F;D)$. As an important point of reference, the graph $U(0;D)$, with

$$U(0;D)=\int_{\bar{n}(0)-\frac{D}{c}}^{\bar{n}(0)} n^{\alpha}dn,$$

$$\frac{dU(0;D)}{dD}=\frac{1}{c}\cdot\left[\bar{n}(0)-\frac{D}{c}\right]^{\alpha}\geq 0,$$

and

$$\frac{d^2U(0;D)}{dD^2}=-\frac{\alpha}{c^2}\cdot\left[\bar{n}(0)-\frac{D}{c}\right]^{\alpha-1}\leq 0,$$

denotes the upper utility boundary for any given project volume. It considers utility as a pure function of donations D, which implies an allocation of the good free of charge. Its concave shape accounts for the impact of the entrepreneur's non-price rationing instrument on the sequence of the applicants' provision. A poorer individual with a likewise higher value is served prior to the next wealthier applicant. The entrepreneur's marginal utility of an additional recipient, therefore, is decreasing. Her aggregated utility reaches a maximum if all applicants are served through donations $(D=\bar{n}(0)\cdot c)$.

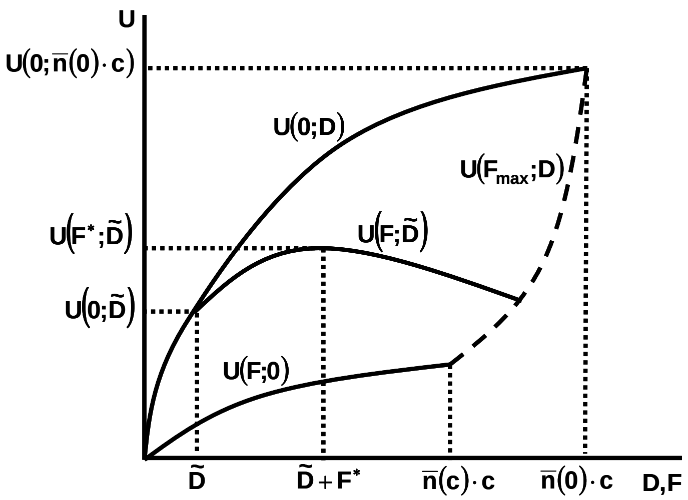

Figure 2.5: A utility function for a moderate level of poverty aversion and the interior optimum.

The lower boundary of the utility spectrum is given by $U(F;0)$, which presumes the non-availability of donations. According to equation (2.3), in this case, the social entrepreneur chooses a user fee equal to marginal costs and allocates the good to applicants successively. The user-fee revenues thereby increase with the quantity of served individuals. The corresponding utility function is given by

$$U(F;0) = \int_{\bar{n}(c)-\frac{F}{c}}^{\bar{n}(c)} n^{\alpha} dn \,,$$

with

$$\frac{dU(F;0)}{dF} = \frac{1}{c} \cdot \left[\bar{n}(c) - \frac{F}{c} \right]^{\alpha} \geq 0$$

and

$$\frac{d^2U(F;0)}{dF^2} = -\frac{\alpha}{c^2} \cdot \left[\bar{n}(c) - \frac{F}{c} \right]^{\alpha-1} \leq 0 \,.$$

The maximum project size is reached at $F_{max} = \bar{n}(c) \cdot c < \bar{n}(0) \cdot c$, i.e. a lower level compared to the maximum volume resulting from complete donation financing.

In figure 2.5, the right increasing dashed graph $U(F_{max};D)$ connects both elements. It depicts the entrepreneur's utility in dependence on the maximum project volume. Since a maximum project size implies $\underline{n} = 0$, $U(F_{max};D)$ is obtained by rearranging the reduced nonprofit-condition (2.11) to $\bar{n}(\ell(F_{max})) = (F_{max} + D)/c$ and inserting it into the utility function:

$$U(F_{max};D) = \int_{0}^{\bar{n}(\ell(F_{max}))} n^{\alpha} dn \,,$$

with

$$\frac{dU(F_{max};D)}{d(F_{max}+D)} = \frac{1}{c} \cdot \left[\frac{F_{max}+D}{c} \right]^{\alpha} > 0$$

and

$$\frac{d^2U(F_{max};D)}{d(F_{max}+D)^2}=\frac{\alpha}{c^2}\cdot\left[\frac{F_{max}+D}{c}\right]^{\alpha-1}\geq 0\,.$$

The curvature shown in figure 2.5 can be explained as follows. The larger the initial donation D is, the less user-fee revenues are needed to reach a certain project volume $F+D$ and, hence, the fewer applicants are excluded. Consequently, more individuals can be served by a further increase of the user fee which extends the maximum project volume.

The three boundaries define the spectrum of possible utility functions. As an example, consider the graph $U\left(F;\tilde{D}\right)$. At $\tilde{D}$ the entrepreneur charges no user fee and the service of the poorest $\tilde{D}/c$ individuals provides her with utility of $U\left(0;\tilde{D}\right)$. The introduction of user fees initially enhances the entrepreneur's utility due to a dominating revenue effect. As the project volume reaches $F^*+\tilde{D}$ the crowding-out effect offsets the revenue effect, and an interior utility maximum results.

2.2.3 VARIATION IN DONATIONS

In figure 2.5, the social entrepreneur's donations amount to $\tilde{D}$ and the project volume $F^*+\tilde{D}$ is chosen. In this section, we analyze how the optimal choice of user-fee revenues and, hence, the optimal project volume change when donations increase. We argue that various results are possible and that their occurrence strongly depends on the entrepreneurs' level of poverty aversion and the status-quo level of donations. More specifically, given that the initial level of donations is sufficiently low, the project volume increases for relatively low levels of poverty aversion and it decreases for relatively high levels. Moreover, there is a specific value of α for which the optimal project size remains unchanged. However, given that the status-quo level of donations is relatively high, all entrepreneurs increase the project volume.

This section primarily focuses on the second entrepreneurial reaction, namely the reduction of the optimal project size, since this appears to be least intuitive. Figure 2.6

characterizes the change of the allocative outcome.[41] The figure shows the direct effect of the exogenous increase of donations and then decomposes the entrepreneur's reaction into two steps. Consider first panel (a). Given a constant user fee, an increase in donations additionally increases the user-fee revenues. This result is obtained by differentiating total entrepreneurial revenues with respect to donations, where user-fee revenues are given by equation (2.2),

$$(2.12)\quad \frac{d\left[F\left(f^*;D\right)+D\right]}{dD}=\frac{f^*}{c-f^*}+1=\frac{c}{c-f^*}.$$

As a consequence, the entrepreneur's marginal utility of charging user fees decreases:

$$(2.13)\quad \left.\frac{\partial^2 U(F;D)}{\partial F\partial D}\right|_{F=F^*}=\frac{\alpha}{c-f^*}\cdot \underline{n}^{\alpha-1}\cdot\left(\overline{n}_F-\frac{1}{c}\right)\le 0.$$

Intuitively, consider the particular project volume $\overline{n}\left(f_1^*\right)-\underline{n}\left(f_1^*;D_1\right)$ at which the crowding-out effect $\left(\left(\overline{n}^\alpha-\underline{n}^\alpha\right)\cdot\overline{n}_F\le 0\right)$ and the revenue effect $\left(\underline{n}^\alpha\cdot(1/c)\ge 0\right)$, as defined by equation (2.9), offset each other. Now, the increase in donations enables the entrepreneur to cover the difference between marginal costs and user fee for previously unconsidered applicants. Moreover, the fee paid by the new recipients additionally increases the entrepreneur's revenues. As a result, the value of the "new" wealthiest recipient $\underline{n}\left(f_1^*;D_2\right)$ is lower and the marginal utility of increasing the user fee becomes negative.

As a consequence, the entrepreneur wishes to reduce the user-fee receipts to readjust the crowding-out and the revenue effect. Given that this reduction does not compensate for the previous increase in total revenues, the optimal project volume rises compared to the status quo. On the other hand, the optimal project size decreases if the user fee reduction overcompensates the previous increase in total revenues. In this case, the absolute change of the entrepreneur's marginal utility (equation (2.9)) is larger for an increase of donations than for a decrease of user-fee revenues.

[41] For notational clarity the terms $\underline{n}(f)$ in figure 2.6 and $F(f)$ are expanded to $\underline{n}(f;D)$ and $F(f;D)$ to emphasize the influence of donations.

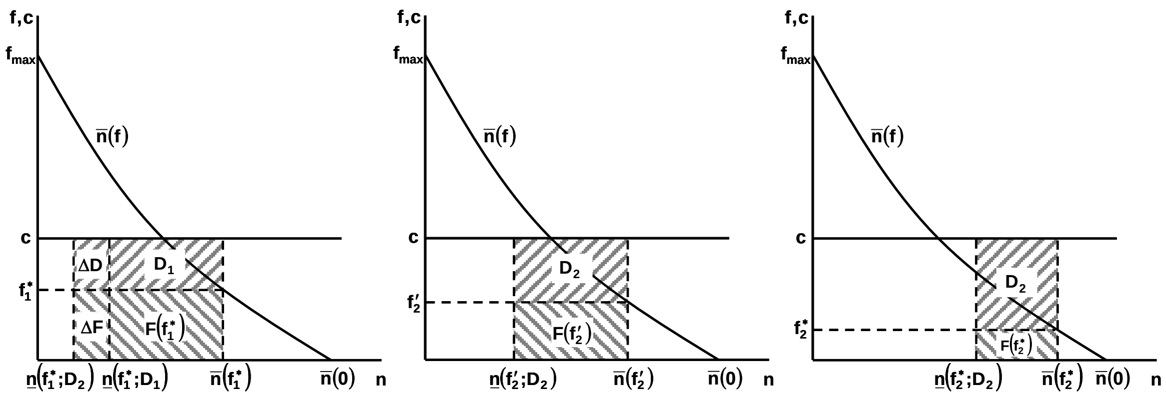

Figure 2.6: A decrease of the optimal project volume as the highly poverty-averse entrepreneurial reaction.

The analysis of the entrepreneur's reduction of user-fee receipts is decomposed into two steps illustrated by panels (b) and (c) in figure 2.6. In panel (b) we consider a first reduction such that the project volume reaches the status-quo level $\left([\overline{n}(f_2') - \underline{n}(f_2'; D_2)] = \left[\overline{n}\left(f_1^*\right) - \underline{n}\left(f_1^*; D_1\right)\right]\right)$. This partial adjustment provides an important result: The equally large reduction of user-fee revenues increases the revenue effect of equation (2.9) to the same extent as the marginal utility decreases due to the additional donations (equation (2.13)).[42] In other words, if we leave the crowding out of recipients unconsidered, any variation in revenues (i.e. donations or user fees) identically affects the entrepreneur's marginal utility. As a consequence, it suffices to analyze the impact of the considered user-fee reduction on the non-positive crowding-out effect. Given that this effect decreases, the resulting total change of the revenue and crowding-out effect is, in absolute terms, larger for an increase of donations than for a decrease of user-fee revenues. We assume this scenario to be given in figure 2.6. Therefore, in panel (b), the entrepreneur's marginal utility of charging additional user fees is negative at the status-quo project volume $\overline{n}(f_2') - \underline{n}(f_2', D_2)$ and the entrepreneur is induced to further reduce user-fee revenues until the new optimal project volume $\overline{n}\left(f_2^*\right) - \underline{n}\left(f_2^*, D_2\right)$ is reached. This outcome is characterized in panel (c).

42 This result is shown within the next proof.

A sufficiently high level of poverty aversion, which exceeds the specific lower limit $\breve{\alpha}$[43], causes a decreasing crowding-out effect for the following reason. In figure 2.6, panel (b), the values of the two marginal recipients $\overline{n}(f_2')$ and $\underline{n}(f_2';D_2)$, as components of this effect, are strictly higher than in panel (a) $\left(\overline{n}\left(f_1^*\right)\text{ and }\underline{n}\left(f_1^*;D_1\right)\right)$. Since both values are weighted exponentially by the entrepreneur's level of poverty aversion, the utility difference between the marginal recipients is larger in panel (b). In other words, the utility loss of substituting the wealthiest for the poorest marginal recipient is c. p. larger, the poorer both individuals are, and, consequently, the lower the non-positive crowding-out effect is.

The effect of increasing donations on the social entrepreneur's utility function is depicted in figure 2.7. According to figure 2.6, the figure likewise characterizes a reduction of the optimal project volume. In the status quo, the entrepreneur receives the donations D_1 and chooses the optimal level of user-fee revenues F_1^*. Now, consider an increase in donations to D_2. Since the entrepreneur shows a relatively high level of poverty aversion, she reduces user-fee receipts to an even larger extent $\left(F_1^* - F_2^* > D_2 - D_1\right)$, which decreases the optimal project volume.

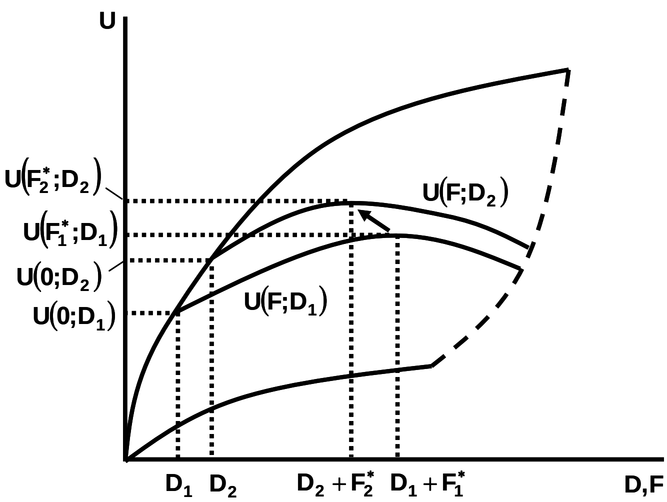

Figure 2.7: The shift of the utility function due to an increase in donations.

[43] The conditions specifying $\breve{\alpha}$ are presented within the next proof. For the current argumentation it suffices to set $\breve{\alpha} > 1$.

It is important to highlight again: The social entrepreneur's choice of a positive level of user-fee revenues in the status quo is a necessary precondition to the characterized result in figures 2.6 and 2.7. According to proposition 2.3, this choice requires that the level of poverty aversion falls short of a specific value $\hat{\alpha}$. However, the entrepreneur reduces the project volume in response to increased donations if her poverty aversion exceeds the lower limit $\breve{\alpha}$. Given that $\hat{\alpha}$ falls short of $\breve{\alpha}$, all entrepreneurs with a poverty aversion level below $\hat{\alpha}$ charge user fees but, given donations increase, all of them react with an enlargement of the project volume. In contrast, those entrepreneurs who, in principle, show the propensity to reduce the optimal project size $(\alpha \geq \breve{\alpha})$ do not charge user fees in the status quo. Instead, their project volume increases by the amount of the additionally obtained donations. Consequently, only if $\breve{\alpha} < \hat{\alpha}$, the predicted behavior occurs. The next proposition shows that a sufficiently low level of status-quo donations ensures that $\breve{\alpha} < \hat{\alpha}$. Moreover, it will be proven that an increase in donations leads to a reduction of the optimal project volume if the entrepreneur's poverty aversion falls between both parameter values.

Proposition 2.5. There exists a level of donations $D' < \overline{n}(0) \cdot c$ and a level of poverty aversion $\breve{\alpha}$, such that for all $D \in [0, D')$ and $\alpha \in (\breve{\alpha}, \hat{\alpha})$, an increase in donations leads to a reduction of the optimal project volume $F^* + D$.

Proof. See Appendix.

Corollary. Given $D \in [0, D')$ and let donations increase, then entrepreneurs with $\alpha = \breve{\alpha}$ do not change and entrepreneurs with $\alpha < \breve{\alpha}$ increase the optimal project volume $F^* + D$.

Proof. Consider again the proof of proposition 2.5. An increase in donations leads to a constant optimal project volume if $dF^* / dD = -c / (c - f^*)$ or, equivalently, if the value of equation (A.2.1), namely Ω, is zero. The proof showed that this is uniquely fulfilled for $\alpha = \breve{\alpha}$. On the other hand, an increase in the optimal project volume requires that $dF^* / dD > -c / (c - f^*)$ which gives a negative sign of Ω. The proof showed that this is fulfilled for all $\alpha < \breve{\alpha}$. **Q.e.d.**

Proposition 2.5 consists of two parts. First, it claims that social entrepreneurs reduce their project volume in response to increased donations if their level of poverty aversion exceeds the lower limit $\breve{\alpha}$. The intuition of the proposition follows the argumentation given previously in this section. Accordingly, for those high levels of α the non-positive crowding-out effect decreases if user-fee revenues are reduced. Moreover, as the corollary outlines, the crowding-out effect and, hence, the optimal project volume remain unchanged if $\alpha = \breve{\alpha}$ and increase if $\alpha < \breve{\alpha}$.

Second, a precondition to the result of the proposition's first part is the imposition of user fees in the status quo or, equivalently, a level of poverty aversion below $\hat{\alpha}$. Only if $\breve{\alpha}$ falls short of $\hat{\alpha}$ there is room for the existence of entrepreneurs decreasing the project volume. This requirement is fulfilled if the status-quo level of donations is sufficiently low. The corresponding intuition proceeds as follows. As the extreme case, consider an entrepreneur with an infinitesimal amount of donations. With these funds at hand she is restricted to serve only an insignificant quantity of individuals. Hence, the exponentially weighted value difference between the marginally poorest and the marginally wealthiest recipient, i.e. the crowding-out effect, is negligible for finite levels of poverty aversion. However, there exists a significant revenue effect because an increase of one unit of user-fee receipts enables the entrepreneur to considerably enlarge the group of recipients compared to the initial quantity. Therefore, the level of poverty aversion $\hat{\alpha}$ at which the negative (and insignificant) crowding-out effect outweighs the positive (and significant) revenue effect is infinitely large. On the other hand, consider an entrepreneur with initial donations sufficing to serve almost all individuals. Here, since the absolute value of the crowding-out effect reaches its maximum whereas the revenue effect becomes infinitesimal ($\underline{n} \rightarrow 0$), the level of poverty aversion at which the crowding-out effect dominates the revenue effect approaches zero. As a result, possible values of $\hat{\alpha}$ range from zero to infinity and are negatively correlated to the status-quo amount of donations.

In contrast, the parameter value $\breve{\alpha}$ is finite. Consider again the discrete project volume depicted in figure 2.6, panel (b). As argued previously, an entrepreneur with the poverty aversion $\breve{\alpha}$ is indifferent between the status-quo volume $\overline{n}(f_2') - \underline{n}(f_2', D_2)$ and a smaller one resulting from a marginal reduction of user fees. Since any of those comparisons always presumes a positive level of user-fee revenues, both project sizes are significant. Consequently, an entrepreneur valuing the two project volumes equally must have a finite level of poverty aversion $\breve{\alpha}$. Comparing this result with the argued range of $\hat{\alpha}$-values, it follows that $\breve{\alpha}$ falls below $\hat{\alpha}$ if the status-quo amount of donations is relatively low.

The results of this section are summarized as follows. Given that the status-quo level of donations is sufficiently low, an increase in donations leads to mixed reactions of social entrepreneurs concerning their optimal choice of the project size (measured in total revenues $F^* + D$). Specifically, relatively low poverty-averse entrepreneurs increase the project volume while those with relatively high aversion decrease it. Moreover, entrepreneurs with a specific value $\breve{\alpha}$ do not change the volume at all. However, given that the status-quo level of donations is relatively high, all entrepreneurs increase the project volume. In the next section, we conclude with a discussion of these results.

2.2.4 CONCLUSION

Our objective in section 2.2 was to develop a positive model of the pricing decision of a social entrepreneur in the light of other exogenous and limited third-party funds. Beside the user fee, we assumed the entrepreneur to handle congestion by applying a non-price rationing instrument. It enables the entrepreneur to provide the good to her most valued applicants that are able to pay the user fee. Moreover, we assumed that the social entrepreneur is poverty averse, i.e. she prefers an individual more, the poorer the person is, and, thus, applied a simplified version of the general motive of inequity aversion. Subject to a nonprofit-condition, the entrepreneur maximizes the aggregated value of served individuals.

Concerning the optimal user fee and, correlated with it, the optimal project volume, we found three qualitatively different outcomes. First, given that the entrepreneur shows no poverty aversion and values all individuals equally, she decides for the user fee which maximizes the project size. Rationing arises exclusively for the poorest applicants who lack the necessary payment ability. Second, if poorer individuals receive a larger value than wealthier applicants, allocations arise, in which a moderate user fee is chosen and applicants on both ends of the income scale are rationed. Finally, given a sufficiently high poverty aversion, the good is allocated for free and the poorest individuals receive the good. In this case, the entrepreneur exclusively rations the wealthiest applicants by use of the non-price allocation mechanism.

As we have shown with our analysis, the introduction of a poverty aversion parameter into the entrepreneur's utility function enables us to explain observable practices of nonprofit organizations. Specifically, we are able to explain differences in the choice of user fees and non-price rationing instruments, as well as their application intensity, even though the organizations operate in the same branch and in the same region.[44] There are social businesses being confronted with substantial congestion but, simultaneously, do not charge user fees at all, such as soup kitchens or homeless shelter.[45] At the other extreme, there may be nonprofit businesses in similar situations charging sufficiently high prices to supply all applicants, such as university cafeterias or youth hostels. One can also observe organizations which set positive user fees and face excess demand. Consider micro-health-insurance schemes in India. Recipients pay relatively low insurance premiums but only certain population groups gain access.[46]

Our analysis additionally showed that an increase of donations might not necessarily lead to an increase of the project volume. Entrepreneurs with relatively high levels of poverty aversion will wish to reduce their user-fee revenues to an even larger extent, although this theoretical phenomenon has yet to be confirmed empirically. Nevertheless, the result should be of particular interest to lead donors, typically granting a significant and often the largest part of the initial financial need of social entrepreneurs.[47] If donor and entrepreneur disagree on the optimal quantity and composition of recipients, their regulation in form of a variation of the donation volume may have unintended effects which should be taken into account.

2.2.5 APPENDIX

Proof of proposition 2.5. Let $D \in [0, \bar{n}(0) \cdot c)$ and $\alpha < \hat{\alpha}$ with

[44] Recall the example mentioned in section 2.1: In Germany, food pantries typically allocate their products through applying a mix of user fees and poverty criteria. Rohrmann (2009) reports that the fraction of pantries, which formulate eligibility requirements, varied between 76.2 percent (2002) and 96 percent (2007). User fees were charged by 65 percent (2002) and 89 percent (2007) of the organizations and differed between 0.50 and 2 Euro per food ration.

[45] In 1998, all 971 New York food pantries analyzed by Food for Survival (2000) charged no user fees, although 34 percent of the pantries had to turn people away.

[46] See McCord et al. (2001).

[47] See Andreoni (1998, 2006).

$$\hat{\alpha} = \left[ln\left(1 - \frac{1}{\overline{n}_F \cdot c}\right) \Big/ \left(ln\,\overline{n} - ln\,\underline{n}\right) \right]\Bigg|_{F=0} .$$

Then, according to proposition 2.3, $F^* > 0$.[48] Now, consider equation (2.12). With $f = f^* > 0$, an increase in donations enlarges the entrepreneur's total income by $c/(c - f^*)$. Consequently, an increase in donations leads to a decrease of the optimal project volume if $dF^*/dD < -c/(c - f^*)$. Applying the implicit function theorem to the first-order condition yields

$$\frac{dF^*}{dD} = -\frac{\partial^2 U(F;D)/\partial F \partial D}{\partial^2 U(F;D)/\partial F^2}\Bigg|_{F=F^*} < -\frac{c}{c - f^*},$$

which can be rearranged to

$$\left[\frac{\partial^2 U(F;D)}{\partial F^2} - \frac{c-f}{c} \cdot \frac{\partial^2 U(F;D)}{\partial F \partial D}\right]\Bigg|_{F=F^*} > 0 .$$

$\partial^2 U(F;D)/\partial F^2$ is given by equation (2.10) and $\left(\partial^2 U(F;D)/\partial F \partial D\right)\big|_{F=F^*}$ by equation (2.13). Hence, the optimal project volume decreases if

$$\text{(A.2.1)} \quad \Omega := \left[\frac{\partial^2 U(F;D)}{\partial F^2} - \frac{c-f}{c} \cdot \frac{\partial^2 U(F;D)}{\partial F \partial D}\right]\Bigg|_{F=F^*} = \left[\left(\overline{n}^{\alpha} - \underline{n}^{\alpha}\right) \cdot \overline{n}_{FF} + \alpha \cdot \overline{n}_F^2 \cdot \left[\overline{n}^{\alpha-1} - \left(1 - \frac{1}{\overline{n}_F \cdot c}\right) \cdot \underline{n}^{\alpha-1}\right]\right]\Bigg|_{F=F^*} > 0 .$$

The two terms of condition (A.2.1) characterize the change of the crowding-out effect due to an increase in user-fee revenues. The first term is positive by definition and the second term is nonnegative for all $\alpha \geq \alpha'$, with

$$\alpha' = 1 + \left[ln\left(1 - \frac{1}{\overline{n}_F \cdot c}\right) \Big/ \left(ln\,\overline{n} - ln\,\underline{n}\right) \right]\Bigg|_{F=F^*} .$$

[48] Although $\hat{\alpha}$ is not defined for $D = 0$, recall that, according to proposition 2.1, all entrepreneurs charge user fees.

Next, we show that a unique $\breve{\alpha} \in (0,\alpha')$ exists for which Ω is zero. Hence, Ω is positive for all $\alpha > \breve{\alpha}$ and negative for all $\alpha < \breve{\alpha}$. Rearranging equation (A.2.1) yields

(A.2.2) $\tilde{\Omega} := y(\alpha,\underline{n}) - z(\alpha,\underline{n})$,

with

$$y(\alpha,\underline{n}) := \left[\left(\bar{n}_{FF} + \alpha \cdot \bar{n}_F^2 \cdot \frac{1}{\bar{n}}\right) \cdot \left(\frac{\bar{n}}{\underline{n}}\right)^{\alpha}\right]\Bigg|_{F=F^*}$$

and

$$z(\alpha,\underline{n}) := \left[\bar{n}_{FF} + \alpha \cdot \bar{n}_F^2 \cdot \left(1 - \frac{1}{\bar{n}_F \cdot c}\right) \cdot \frac{1}{\underline{n}}\right]\Bigg|_{F=F^*}.$$

With $\bar{n} > \underline{n}$, $\bar{n}_F < 0$, and $\bar{n}_{FF} > 0$, $y(\alpha,\underline{n})$ is the product of a linear and a convex increasing function of α. Hence, $y(\alpha,\underline{n})$ is also increasing and convex in α. On the other hand, $z(\alpha,\underline{n})$ is linearly increasing in α. Consequently, the difference of both terms, $\tilde{\Omega}$, has maximally two roots. Apparently, one is given for $\alpha = 0$.[49] There exists a second root for $\alpha = \breve{\alpha} > 0$ if and only if $(dy(\alpha,\underline{n})/d\alpha)|_{\alpha=0} < (dz(\alpha,\underline{n})/d\alpha)|_{\alpha=0}$, i.e.

$$y_\alpha := \left(\frac{dy(\alpha,\underline{n})}{d\alpha}\right)\Bigg|_{\alpha=0} = \bar{n}_F^2 \cdot \frac{1}{\bar{n}} + \bar{n}_{FF} \cdot ln\left(\frac{\bar{n}}{\underline{n}}\right) < \bar{n}_F^2 \cdot \left(1 - \frac{1}{\bar{n}_F \cdot c}\right) \cdot \frac{1}{\underline{n}} = \left(\frac{dz(\alpha,\underline{n})}{d\alpha}\right)\Bigg|_{\alpha=0} =: z_\alpha .$$

This condition holds since $\alpha \to 0$ implies that $F^* \to F_{max}$ and $\underline{n} \to 0$.[50] Although the limits of y_α and z_α are infinity for $\underline{n} \to 0$, the application of l'Hôpital's rule shows that y_α and z_α diverge and $z_\alpha > y_\alpha$ results:

$$\lim_{\underline{n}\to 0} \frac{y_\alpha}{z_\alpha} = \lim_{\underline{n}\to 0} \left[\frac{\left(\partial^2 y(\alpha,\underline{n})/\partial\alpha\partial\underline{n}\right)}{\left(\partial^2 z(\alpha,\underline{n})/\partial\alpha\partial\underline{n}\right)}\right]\Bigg|_{\alpha=0} = \lim_{\underline{n}\to 0} \left[\frac{\bar{n}_{FF} \cdot \underline{n}}{\bar{n}_F^2 \cdot [1 - (1/(\bar{n}_F \cdot c))]}\right] = 0 .$$

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[49] This technical result does not imply that non-poverty-averse entrepreneurs do not change their project size if donations increase. Rather, in line with proposition 2.4, non-poverty-averse entrepreneurs behave project-size maximizing. Consequently, their project volume increases with higher donations. The zero-value of equation (A.2.1) emanates from the fact, that a crowding-out effect does not exist for $\alpha = 0$ and, hence, does not change if user-fee revenues are increased.

[50] Rearranging the first-order condition (setting equation (2.9) zero) yields $\underline{n} = \bar{n} \cdot \left[1 - 1/(\bar{n}_F \cdot c)\right]^{-1/\alpha}$ with $\lim_{\alpha \to 0} \bar{n} \cdot \left[1 - 1/(\bar{n}_F \cdot c)\right]^{-1/\alpha} = 0$.

Consequently, there exists a unique $\breve{\alpha} \in (0,\alpha')$ for which the value of $\tilde{\Omega}$, or respectively Ω, is zero.

Yet, we assumed that $\alpha < \hat{\alpha}$ and derived the requirement, that $\alpha > \breve{\alpha}$. Consequently, an increase in donations leads to a reduction of the optimal project volume if $\breve{\alpha} < \hat{\alpha}$ and $\alpha \in (\breve{\alpha},\hat{\alpha})$. However, $\breve{\alpha} < \hat{\alpha}$ requires a sufficiently low level of donations. For $D \to \overline{n}(0) \cdot c$, $ln\,\overline{n} - ln\,\underline{n}$, which determines $\hat{\alpha}$ and α', is infinitely large, such that $\hat{\alpha} \to 0$ and $\alpha' \to 1$. Since $\breve{\alpha} < \alpha'$, it must hold that $\breve{\alpha} \in (0,1)$ and, consequently, $\breve{\alpha} > \hat{\alpha}$. In other words, given that the amount of donations is relatively high, all entrepreneurs react with an enlargement of the project volume on an increase in donations. In contrast, for $D \to 0$, $(ln\,\overline{n} - ln\,\underline{n})|_{F=0} \to 0$ and, hence, $\hat{\alpha} \to \infty$. According to proposition 2.3, all entrepreneurs with $\alpha < \hat{\alpha}$ choose F^*>0. Consequently, $(ln\,\overline{n} - ln\,\underline{n})|_{F=F^*} > 0$ and $\alpha' \in (1,\infty)$. Since $\breve{\alpha} < \alpha'$, it holds that $\breve{\alpha} < \hat{\alpha}$. As a result, there exists a specific level of donations D' such that $\breve{\alpha} = \hat{\alpha}$, if $D = D'$, and $\breve{\alpha} < \hat{\alpha}$, if $D \in [0,D')$. Hence, for all $D \in [0,D')$ an increase in donations leads to a reduction of the optimal project volume $F^* + D$, if $\alpha \in (\breve{\alpha},\hat{\alpha})$. **Q.e.d.**

2.3 RATIONING BY USER-FEE DISCRIMINATION AND QUALITY DILUTION[51]

In this section, we analyze how the entrepreneur's decision behavior changes when she decides not only on the poverty composition and the quantity of recipients, but also on the quality of the social good. Additionally, we allow the entrepreneur to price discriminate individuals perfectly. As in the previous analysis, at first, we characterize allocation patterns in dependence on the entrepreneur's inequity aversion. Afterwards, we analyze how a variation in donations and input costs impacts her rationing behavior.

2.3.1 THE MODEL

Again, consider a continuum of individuals $\mathcal{N} = [n_{min}, n_{max}] \subseteq R_+^*$ seeking to satisfy a basic human need. Each individual $n \in \mathcal{N}$ is willing to spend a budget $b(n)$ on purchasing one

[51] With little modification, this section is taken from Burchhardt and Starke (2010).

unit of a need-specific good. We assume that individuals are ordered according to their willingness to pay, such that $db(n)/dn < 0$ and $b(n_{max}) = 0$. Different product qualities of the good are available on perfectly competitive markets where firms face zero profits, and the price of the good increases with its quality level. We distinguish individuals only by their budget and, therefore, assume that consumers' preferences are identical. Moreover, their marginal utility of quality is strictly positive. The latter assumptions reflect the basic-human-need character of the good. Intuitively, for this type of goods consumer preferences are similar and relatively intensive until a minimum quality level is reached. For example, the minimum level for food might be given by a balanced periodical nutrition. Together, as in section 2.2, our specifications of consumer preferences allow us to treat the terms willingness to pay and payment ability equally and, thus, to differentiate individuals by their income, i.e. poverty level. Accordingly, the individual n_{max} is the poorest whereas n_{min} represents the wealthiest individual.

Suppose a social entrepreneur is able to perfectly observe individual budgets. This assumption is supported by nonprofit practices, implying that it is quite common to differentiate the financial situation of needy people either through income verification sheets or through appropriate indicators.[52] Moreover, Steinberg and Weisbrod (2005) argue that individuals may be willing to reveal their payment willingness to nonprofit but not to for-profit organizations. The social entrepreneur compares the individual budgets with a subjective social reference level b_{sr}, which might be equal to her own consumption budget or might be deduced from scientific or regulatory guidelines.[53] This reference level determines the individuals the entrepreneur considers needy. For reasons of simplicity, we assume that all n individuals own a budget endowment equal or below this level, i.e. $b_{sr} = b(n_{min})$. Consequently, the social entrepreneur observes a budgetary inequity of $q_{ea}(n) := b_{sr} - b(n) \geq 0$ for the nth individual, which will be referred to in the following as *ex-ante inequity*.

[52] Steinberg and Weisbrod (1998) provide a general discussion of these indicators. More specifically, FAO (2001) surveys and discusses the application of indicators of several nutrition programs in developing countries (e.g. socio-economic status, education level, age, household size, number of children etc.). As argued in footnote 34, although such practices are supposed to cause so-called targeting costs, again, we simplify by ignoring them.

[53] Exemplarily, the UK government (School Food Trust 2007) defined a minimum quality for school food by pinpointing items that have to be offered within a specific period.

In order to mitigate the ex-ante inequity the nonprofit entrepreneur offers one unit of a need-specific social good to any preselected individual. This selection is based on two related decisions: Which product quality should be offered and which needy subgroup should be targeted? We make three assumptions about the quality of the social good. First, the good is provided to all recipients at uniform quality, i.e. we do not consider quality discrimination. Second, the marginal costs of producing an additional unit of the social good $c \in R_{+}^{*}$ are independent of the supplied quantity but positively correlated to the product's quality level.[54] In the following, we do not distinguish between quality and marginal production costs and denote quality equivalently by c. Third, for reasons of simplicity, it is assumed that the quality of the social good is produced with the same technology as the market good.

In order to illustrate the setting we have in mind, consider the following application to food-consumption. Here, the good is viewed as a bundle of staple foods of specific quantity and quality. Any change in the composition of the bundle that increases need satisfaction is modeled as an increase in the good's quality. Hence, an increase in the number and scope of meals through additional food as well as an increase in the quality of a single item enhances the overall quality.

The second decision of the social entrepreneur concerns the composition and size of the target group. As will be argued by the following assumptions, this decision solely requires the choice of the marginally poorest recipient $\overline{n} \in \mathcal{N}$. First, we define $\underline{n} \in [n_{min}, \overline{n})$ as the marginally wealthiest recipient and we assume that the group of served individuals lies in the closed interval $[\underline{n}, \overline{n}]$, with the quantity of recipients given by $\overline{n} - \underline{n}$. Furthermore, we allow the entrepreneur to perfectly discriminate prices. The differentiation of user fees according to payment ability, which is often observed in practice, is a basic assumption in models of nonprofit firms.[55] In this regard, Hansmann (1980) as well as Steinberg and Weisbrod (1998) provide numerous examples of nonprofit industries

[54] A different approach is taken by Rose-Ackerman (1987), who argues that the marginal costs of quality for the provision of social goods are zero. Although sharing the opinion that there exist some factors improving quality without additional costs, e.g. changing school teaching from frontal to interactive mode, we account for the majority of dimensions where improvements in quality are costly.

[55] Theoretical aspects of price discrimination by nonprofits are studied in Le Grand (1975) and Steinberg and Weisbrod (2005).

frequently charging sliding-scale fees for different users. In our model, the social entrepreneur charges the *n*th individual a user fee that exactly corresponds to the budget endowment $b(n)$. The individual purchases the social good, if its quality c does not fall short of the user-fee level, i.e. $c \geq b(n)$, or, in other words, if its quality is at least as high as the affordable quality of the market good.[56] Consequently, the entrepreneur's total user-fee revenues F are given by

(2.14) $$F = \int_{\underline{n}}^{\overline{n}} b(n)\, dn .$$

In addition to these revenues, the entrepreneur receives an exogenously given level of donations $D \in (0, D_{max})$, with

$$D_{max} = [(n_{max} - n_{min}) \cdot b_{sr}] - \int_{n_{min}}^{n_{max}} b(n)\, dn$$

as the maximum level at which all individuals are served at social reference quality. In line with the organization's nonprofit status user-fee revenues and donations have to be spent completely on financing the allocation of the social good to needy individuals, i.e.

(2.15) $$F + D = c \cdot (\overline{n} - \underline{n}) .$$

The *nonprofit-condition* (2.15) shows that for given levels of donations D and individual budgets $b(n)$, the entrepreneur's choice of the good's quality c and the marginally poorest recipient $\overline{n}$ determines the marginally wealthiest recipient $\underline{n} = \underline{n}(c, \overline{n})$ and, likewise, the size of the target group $\overline{n} - \underline{n}(c, \overline{n})$. These dependencies are depicted in figure 2.8.

Given the individual endowments $b(n)$, the social entrepreneur is confronted with the status-quo budgetary inequity $q_{ea}(n) = b_{sr} - b(n)$. With donations D at hand, she decides on the quality level c of the social good and determines the specific target group by choice of the poorest recipient $\overline{n}$. Due to the nonprofit-condition, she completely spends donations to cover the difference between marginal costs c and individual contributions.

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[56] Recall that firms face zero profits in perfectly competitive markets and use the identical production technology as nonprofit organizations. Consequently, the quality an individual purchases from the market equals the budget which is spent.

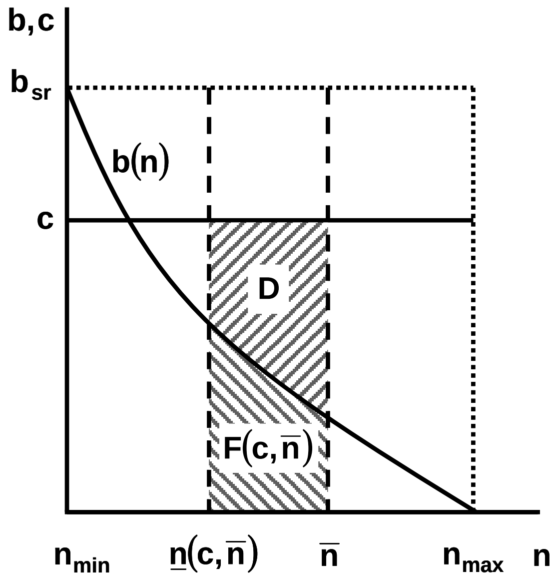

Figure 2.8: Allocation effects of the choice of quality and target group.

Starting with the poorest recipient the funds suffice to subsidize $\bar{n}-\underline{n}(c,\bar{n})$ individuals. Since recipients have to pay a user fee equal to their payment abilities, total user-fee revenues amount to $F(c,\bar{n})$. Subsequent to the allocation of the social good, there remains an inequity with served individuals amounting to $q_{ep}(c):=b_{sr}-c$, which will be referred to as *ex-post inequity* in the following. With the choice of her allocation the entrepreneur simultaneously shows two types of rationing. First, by choosing the target group she completely rations all individuals $n \notin [\underline{n}(c,\bar{n}),\bar{n}]$. Second, her determination of a quality level partially rations all recipients since they do not receive the social reference level.

As motivated in this chapter's introduction, we characterize the social entrepreneur as an inequity-averse decision maker. Specifically, she draws a negative utility from a deviation of an individual's consumption possibilities $b(n)$ from the social reference level. By providing needy individuals with the social good she reduces the inequity and, hence, her own disutility.

The inequity-aversion motive is introduced into our model through the parameter $\alpha \in R_{+}$. It determines the social entrepreneur's disutility from inequity by exponentially weighting $q_{ea}(n)$ and $q_{ep}(c)$, respectively. The functional form of her disutility can be written as

(2.16) $v(q) = q^{\alpha}$, with $q \in \{q_{ea}(n), q_{ep}(c)\}$.

The parameter α thereby determines the level of the constant elasticity of marginal disutility $\varepsilon = \alpha - 1$ and is likewise a measure for the curvature of value function (2.16).[57] Additionally, as with the class of Cobb-Douglas utility functions, α characterizes the entrepreneur's intensity of disutility. Marginal disutility is decreasing with $\alpha \in (0,1)$, constant with $\alpha = 1$, and increasing with $\alpha \in (1,\infty)$.[58] More specifically, an entrepreneur with $\alpha = 0$ does not care about differences in budgetary inequity between individuals and values $q_{ea}(n)$ and $q_{ep}(c)$ identically. In contrast, for any positive α the entrepreneur draws an increased disutility from individuals being subject to higher inequity. This increase in disutility is the larger the higher the value of α is, and it becomes infinite with $\alpha \to \infty$.[59] As will be shown later, entrepreneurs with extreme inequity aversion care only for the poorest target group individuals.

Based on the introduced disutility concept, we now characterize the social entrepreneur's utility from allocating one unit of the social good to a target group individual by the following functional form:

(2.17) $u(c,n) = v(q_{ea}(n)) - v(q_{ep}(c)) = [b_{sr} - b(n)]^{\alpha} - (b_{sr} - c)^{\alpha}$.

Her utility equals the difference between the weighted ex-ante and ex-post inequity, i.e. the reduction of disutility through provision of the social good. As intuitive result, a non-inequity-averse entrepreneur $(\alpha = 0)$ receives no utility from allocating the good independent of the type of recipient. Hence, she does not engage in the social-good provision.

As previously argued, by simultaneously choosing the quality level c of the social good and the poorest recipient $\overline{n}$, the entrepreneur, due to nonprofit condition (2.15), indirectly determines the wealthiest recipient $\underline{n}(c,\overline{n})$ and, hence, also the quantity of

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[57] The elasticity of marginal disutility is defined as $\varepsilon = [dv'(q)/dq] \cdot [q/v'(q)]$.

[58] With these specifications of marginal disutility we broaden the scope of Fehr and Schmidt (1999), who integrate α multiplicatively into the utility function and, hence, restrict their analysis to *linear* inequity aversion, i.e. constant marginal disutility. However, they also observe "a nonnegligible fraction of people who exhibit nonlinear inequality aversion" in dictator experiments (p. 823).

[59] Note that the case $\alpha = \infty$ corresponds to maximin-preferences.

served individuals, $\bar{n} - \underline{n}(c,\bar{n})$. Aggregating the utility values of equation (2.17) for each recipient then yields the following total utility level:

$$(2.18)\quad U(c,\bar{n},\underline{n}(c,\bar{n})) = \int_{\underline{n}(c,\bar{n})}^{\bar{n}} \left[[b_{sr} - b(n)]^{\alpha} - (b_{sr} - c)^{\alpha} \right] dn .$$

For reasons of tractability, the notation of utility function (2.18) includes the entrepreneur's decision variables c and $\bar{n}$ as well as their influence on the value of the wealthiest recipient $\underline{n}(c,\bar{n})$. We thereby allow for a precise characterization of the entrepreneur's scope of alternatives: Under consideration of nonprofit-condition (2.15), the entrepreneur can (directly or indirectly) vary two of the variables with the third kept constant. The maximization problem of the entrepreneur is given by

$$(2.19)\quad \begin{aligned} &\max_{c,\bar{n}} \; U(c,\bar{n},\underline{n}(c,\bar{n})) \\ &\text{s.t. } D - \int_{\underline{n}}^{\bar{n}} [c - b(n)]\, dn = 0 . \end{aligned}$$[60]

In the following, we prove the existence of corner and interior solutions to maximization problem (2.19).[61]

Proposition 2.6. Weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$ choose the maximum quality $(c^* = b_{sr})$ and provide only the wealthiest individuals $(\underline{n}(c^*,\bar{n}^*) = n_{min})$. On the other hand, highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ serve only the poorest applicants $(\bar{n}^* = n_{max})$ at the lowest feasible quality $(c^* = b(\underline{n}(c^*,n_{max})))$. Finally, interior optima $(c^* \le b_{sr}$ and $\bar{n}^* \le n_{max})$ only exist if $\alpha = 1$.

Proof. See Appendix.

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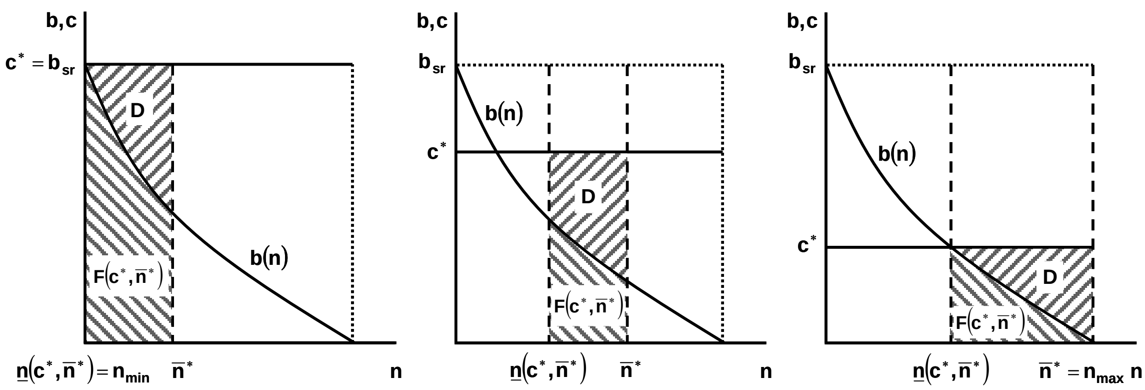
[60] Employing equation (2.14) into nonprofit-condition (2.15) and rearranging it with respect to D yields $D = \int_{\underline{n}}^{\bar{n}} [c - b(n)] dn$.

[61] Utility function (2.18) is similar to the normative poverty measure put forward by Foster et al. (1984). Applying this measure Bourguignon and Fields (1990) analyze optimal governmental subsidies to individuals. Their findings resemble the results of proposition 2.6.

If donations are insufficient to serve all needy individuals, the social entrepreneur chooses the mix of quality and recipients that maximizes her utility from reduced inequity under the fulfillment of nonprofit-condition (2.15). As proposition 2.6 shows, a first maximum is given for weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$. Their marginal utility of serving the next poorer recipient is always lower than both their marginal utility of an improvement in quality (given a constant wealthiest recipient) and their marginal utility of serving the next wealthier recipient (given a constant quality). Consequently, the entrepreneur maximizes the social-good quality $\left(c^* = b_{sr}\right)$ and serves only the wealthiest recipients $\left(\underline{n}(c^*, \overline{n}^*) = n_{min}\right)$. Intuitively, weakly inequity-averse entrepreneurs show the highest marginal disutility of inequity for marginal deviations of individual budgets from the social reference level. As immediate consequence, the first unit of donations (in form of the social good) is used to completely eliminate the inequity of the wealthiest needy individual $(n \to n_{min})$ which requires the entrepreneur to choose the maximum quality for the good. Until the entire donations are spent, individuals are successively supplied according to the next higher inequity. The characterized corner solution is depicted in figure 2.9, panel (a).



(a) (b) (c)

Figure 2.9: Corner allocations and an arbitrary interior solution.

Second, interior optima $\left(c^* \leq b_{sr} \text{ and } \overline{n}^* \leq n_{max}\right)$ exist for moderately inequity-averse entrepreneurs $(\alpha = 1)$. Their marginal utility of a change in each of the three variables is equally large, which allows for any values that satisfy nonprofit-condition (2.15).

Entrepreneurs in this category show a constant marginal disutility of inequity and, thus, do not care for which applicants and to what level inequity is reduced. An arbitrary interior solution is characterized in figure 2.9, panel (b). Throughout the rest of section 2.3 the case of $\alpha = 1$ will no longer be analyzed. Independent of the subsequently considered parameter variations it can be shown that the marginal utilities of quality, the wealthiest and the poorest recipient remain equally large. Consequently, any allocation satisfying nonprofit-condition (2.15) is optimal and, therefore, $\alpha = 1$ has no further explanatory value.

Third, the marginal utility of highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ is lower for an improvement in quality than for a provision of both the next poorer and the next wealthier recipient. The resulting allocation is depicted in figure 2.9, panel (c). Here, only the poorest recipients $\left(\overline{n}^* = n_{max}\right)$ are served at the minimum quality $\left(c^* = b(\underline{n}(c^*, \overline{n}^*))\right)$.[62] The intuition runs contrary to that of panel (a). Since the marginal disutility from inequity is largest for the highest inequity level, utility is maximized, if donations are transferred to the poorest individuals $\left(n_{max} - \underline{n}(c^*, \overline{n}^*)\right)$, such that the ex-post inequity is equal across recipients but highest across all needy individuals. This procedure determines the low quality level of the social good.

In addition to these findings, figure 2.9 (panel (c)) indicates that highly inequity-averse entrepreneurs choose to serve the largest quantity of needy individuals $\left(\overline{n}^* - \underline{n}\left(c^*, \overline{n}^*\right)\right)$. However, this result only holds if the function of budget endowments $b(n)$ is convex. More specifically, differences in the chosen target-group quantity depend on both the social entrepreneurs' inequity aversion and the curvature of the $b(n)$-function, as we show formally with the following proposition.

Proposition 2.7. Highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ serve the maximum quantity of individuals $\overline{n}^* - \underline{n}\left(c^*, \overline{n}^*\right)$, if the $b(n)$-curve is convex. In contrast, if $b(n)$ is concave, then the quantity of recipients is largest for weakly inequity-averse entrepreneurs ($\alpha \in (0,1)$). However, both types of entrepreneurs choose the same and likewise maximum quantity of recipients if $b(n)$ is a linear function.

[62] Interestingly, this is also the optimal allocation under maximin-preferences.

***Proof*.** See Appendix.

Intuitively, the maximum quantity of individuals is served if the required average subsidy margin, i.e. the average difference between constant marginal production costs c and the perfectly discriminated user fee $b(n)$, is lowest. There are two requirements to a minimal average subsidy. First, since marginal production costs are assumed to be equal across individuals, and $b(n)$ is a decreasing function in n, any target group is served with the lowest possible amount of donations, if the wealthiest recipient receives no subsidy. Otherwise, any positive subsidy to this individual would have to be likewise granted to each other recipient, implying increased spending of donations. Second, a minimum average subsidy margin arises among those recipients whose budgets are most uniformly distributed. For those individuals the gap between costs and user fee $c - b(n)$ is smallest on average.

Following proposition 2.6, the first requirement is met for all entrepreneurs with $\alpha \in (0,\infty) \setminus \{1\}$. However, the fulfillment of the second requirement depends on the curvature of the function of budget endowments $b(n)$. Given that $b(n)$ is convex, individual budgets vary least among the poorest individuals, such that highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ serve the maximum quantity of recipients. In contrast, given a concave $b(n)$-function, budgets are most uniformly distributed among the wealthiest individuals which are supplied by weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$. Consequently, they serve the maximum quantity of recipients. Finally, there exist no such differences in the distribution of individual budgets, if the $b(n)$-curve is linear, which implies an equal and maximum target-group quantity for all entrepreneurs with $\alpha \in (0,\infty) \setminus \{1\}$.

2.3.2 VARIATIONS IN DONATIONS AND INPUT COSTS

As argued in section 2.3.1, the determinants of the social entrepreneur's allocation decision include available third-party funds and production costs. These financial conditions are likely to change during the lifetime of a social business. A donor might withdraw or extend announced funds or might simply terminate a long-term relationship. Input costs might vary due to periodic shortages or shocks on resource markets. In this section, we analyze the impact of those variations on the entrepreneur's choice of target group and social-good quality.

In principle, the social entrepreneur can alternatively use additional donations to serve more or different individuals, or to improve the quality of the social good. The next proposition shows that, on the one hand, entrepreneurs react differently on variations in donations but, on the other hand, the classification of corner and interior solutions by level of inequity aversion remains unaffected.[63]

Proposition 2.8. Given an increase in donations, entrepreneurs with $\alpha \in (0,\infty)\setminus\{1\}$ enlarge the quantity of served individuals $\left(\bar{n}^{D*} - \underline{n}\left(c^{D*}, \bar{n}^{D*}\right) > \bar{n}^{*} - \underline{n}\left(c^{*}, \bar{n}^{*}\right)\right)$. In particular, weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$ keep serving the wealthiest individuals $\left(\underline{n}\left(c^{D*}, \bar{n}^{D*}\right) = \underline{n}\left(c^{*}, \bar{n}^{*}\right) = n_{min}\right)$ at the social reference level $\left(c^{D*} = c^{*} = b_{sr}\right)$ and expand their target group toward the next poorer individuals $\left(\bar{n}^{D*} > \bar{n}^{*}\right)$. In contrast, highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ still focus on the most needy individuals $\left(\bar{n}^{D*} = \bar{n}^{*} = n_{max}\right)$, improve the social-good quality $\left(c_{D}^{*} > c^{*}\right)$ and serve the next wealthier applicants $\left(\underline{n}\left(c^{D*}, \bar{n}^{D*}\right) < \underline{n}\left(c^{*}, \bar{n}^{*}\right)\right)$.

Proof. See Appendix.

Intuitively, an increase in donations does not affect the entrepreneur's marginal disutility of ex-ante inequity as obtained from equation (2.16). Hence, there is no effect on her decision on how to reduce this inequity optimally, i.e. the order of her marginal utilities of quality c, marginally poorest recipient $\bar{n}$, and marginally wealthiest beneficiary $\underline{n}(c, \bar{n})$ remains unchanged. Consequently, entrepreneurs with $\alpha \in (0,1)$ still have the highest marginal disutility for the lowest levels of inequity which incites them to serve the wealthiest individuals $\left(\underline{n}\left(c^{D*}, \bar{n}^{D*}\right) = \underline{n}\left(c^{*}, \bar{n}^{*}\right) = n_{min}\right)$ at social reference quality

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[63] In the following the entrepreneur's decision variables are superscripted by D to account for the state of increased donations.

$\left(c^{D*} = c^* = b_{sr}\right)$. These recipients now comprise the ex-ante target group and, additionally, the next poorer applicants $\left(\bar{n}^{D*} > \bar{n}^*\right)$. Entrepreneurs with $\alpha \in (1,\infty)$, on the other hand, eliminate the maximum disutility of inequity, if they keep on serving the poorest individuals $\left(\bar{n}^{D*} = \bar{n}^* = n_{max}\right)$ at minimum quality. Additional donations are spent on serving the next wealthier applicants. However, these individuals are only willing to purchase the social good, if its quality is at least equal to their budget endowment. Hence, the entrepreneur, likewise, improves quality unless the wealthiest recipient is indifferent between the market and the social good $\left(c^{D*} = b\left(\underline{n}\left(c^{D*}, \bar{n}^{D*}\right)\right)\right)$. Consequently, the model predicts an increase in both the quantity of recipients and the social-good quality as reaction to an increase in third-party funds.

As a second variation, consider a general increase in input costs (in the following indexed by superscript I). Note that in section 2.3.1 we assumed perfectly competitive for-profit markets and identical quality-production technologies of for- and nonprofit firms. These assumptions imply that, for a constant quality, the increase in input costs equally increases the price of the market good. Additionally, it still holds that any individual owning a budget equal or below the quality level c^I applies for the social good and individuals with $b(n) > c^I$ demand the market good. The increase in input costs is reflected by a change of two parameters. First, the social reference budget increases $\left(b_{sr}^I > b_{sr}\right)$ because higher expenditures are required to purchase the corresponding consumption quality. Second, we assume that the total quantity of needy individuals enlarges by those people who are no longer able to afford the social reference consumption. As a result, the set of needy individuals is now characterized by $\mathcal{N}^I = \left[n_{min}^I, n_{max}\right] \subseteq R_+^*$ with $n_{min}^I < n_{min}$ and $b_{sr}^I = b\left(n_{min}^I\right)$.

Given that the social entrepreneur does not change marginal production costs $\left(c^I = c\right)$, she is restricted to use qualitatively lower or less inputs per unit of the social good, which deteriorates its quality. Alternatively, she could increase c^I to keep the quality constant, but this, according to nonprofit-condition (2.15), would imply a decrease in the quantity of served individuals. As proposition 2.9 shows, an increase in input costs leads to contrary reactions of social entrepreneurs depending on their level of inequity aversion.

Proposition 2.9. For weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$ an increase in input costs leads to a provision of wealthier individuals $\left(\underline{n}\left(c^{I*}, \overline{n}^{I*}\right) = n^I_{min}\right)$ at (unchanged) social reference quality $\left(c^{I*} = b^I_{sr}\right)$. In contrast, highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ keep serving the status-quo target group $\left(\overline{n}^{I*} = \overline{n}^{*} = n_{max}\right.$ and $\left.\underline{n}\left(c^{I*}, \overline{n}^{I*}\right) = \underline{n}\left(c^{*}, \overline{n}^{*}\right)\right)$ at constant marginal costs $\left(c^{I*} = c^{*} = b\left(\underline{n}\left(c^{*}, n_{max}\right)\right)\right)$, i.e. lower quality.

Proof. See Appendix.

Weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$ show the highest marginal disutility of ex-ante inequity for marginal deviations of individual budgets $b(n)$ from the social reference level. An increased budget b^I_{sr} required to consume the social-reference quality and a simultaneously enlarged quantity of needy individuals $\left(n_{max} - n^I_{min} > n_{max} - n_{min}\right)$, thus, renders the initial choices of marginal costs $\left(c^{*} = b_{sr}\right)$ and target group $\left(\underline{n}\left(b_{sr}, \overline{n}^{*}\right) = n_{min}\right)$ suboptimal. The entrepreneur reacts by increasing marginal costs to b^I_{sr} and shifting the target group toward the 'new' wealthiest applicants $\left(\underline{n}\left(b^I_{sr}, \overline{n}^{I*}\right) = n^I_{min}\right)$. This way, she eliminates the fraction of inequity with the highest disutility. As figure 2.10 indicates, a complete shift in the target group occurs, if b^I_{sr} is such that donations are insufficient to allocate the good to more than the "new" applicants at social reference quality, i.e.

$$D \leq \int_{n^I_{min}}^{n_{min}} \left[b^I_{sr} - b(n)\right] dn .$$

No initially served individual is further considered by the entrepreneur.

In contrast, the marginal disutility of highly inequity-averse entrepreneurs $(\alpha \in (1,\infty))$ increases with the inequity level. As shown in section 2.3.1, they choose to serve the poorest individuals $\left(\overline{n}^{*} = n_{max}\right)$ at minimum quality $\left(c^{*} = b\left(\underline{n}\left(c^{*}, n_{max}\right)\right)\right)$. Since an increase

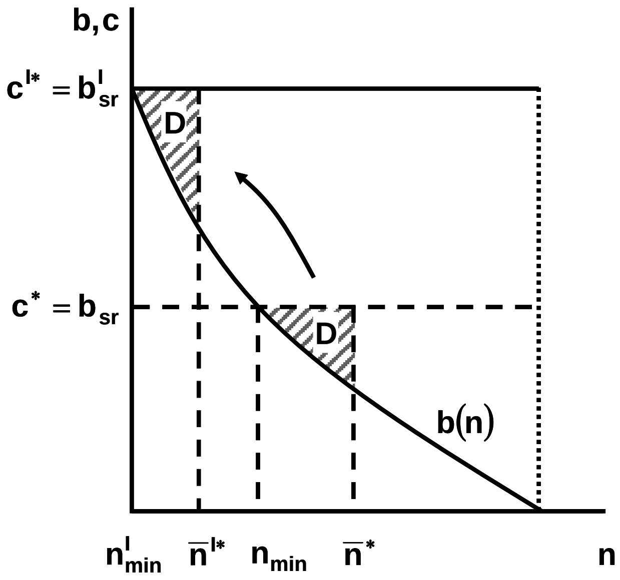

Figure 2.10: A complete shift of the target group as a weakly inequity-averse reaction on an increase in input costs

in input costs exerts no effect on the relative poverty of individuals, i.e. the individuals within the set $[\underline{n}(c^*, n_{max}), n_{max}]$ are still poorest, the entrepreneur neither changes the target group $(\bar{n}^{I*} = \bar{n}^* = n_{max}$ and $\underline{n}(c^{I*}, \bar{n}^{I*}) = \underline{n}(c^*, \bar{n}^*))$ nor the marginal production costs $(c^{I*} = c^* = b(\underline{n}(c^*, n_{max})))$. However, quality necessarily drops due to increased input costs**.**

Additionally, figure 2.10 indicates that a weakly inequity-averse social entrepreneur not only changes the composition of recipients but also their quantity. The next proposition shows that this change unambiguously depends on the curvature of the budget function $b(n)$.

Proposition 2.10. Given a concave (convex) function of budget endowments $b(n)$, weakly inequity-averse entrepreneurs $(\alpha \in (0,1))$ increase (decrease) the quantity of served individuals, i.e. $\bar{n}^{I*} - \underline{n}(c^{I*}, \bar{n}^{I*}) > \bar{n}^* - \underline{n}(c^*, \bar{n}^*)$ $(\bar{n}^{I*} - \underline{n}(c^{I*}, \bar{n}^{I*}) < \bar{n}^* - \underline{n}(c^*, \bar{n}^*))$, as a reaction to an increase in input costs. Given a linear budget function, they do not change the quantity of recipients.

Proof. See Appendix.

From proposition 2.7, we know that the quantity of recipients is negatively correlated with the average subsidy margin required to serve the targeted individuals. Since the wealthiest recipient receives no subsidy independent of the input costs, this margin is only conditional on the distribution of individual budget endowments, i.e. the curvature of the $b(n)$-function. The average subsidy is thereby the smaller the more uniformly budgets are distributed. Given that $b(n)$ is concave, the dispersion is lowest among the highest budgets. Consequently, the target group is larger after input costs increased, because recipients are wealthier on average. However, the ex-post quantity is smaller if $b(n)$ is convex, which is exemplarily depicted in figure 2.10. Here, individual budgets are least uniformly distributed among the wealthiest applicants. Finally, due to the same reasoning, no differences occur if $b(n)$ is linear.

2.3.3 CONCLUSION

Our objective in section 2.3 was to develop a positive model of a nonprofit entrepreneur's allocation decision, which includes the selection of the target group and the quality of the social good, in the light of limited third-party funds. By assuming that a social entrepreneur`s decision is characterized by inequity aversion, we follow recent results of experimental economic research on social preferences. We demonstrate how this preference assumption conveys a better understanding of how the good's quality, the quantity of recipients as well as their income distribution interact within the objective function of private nonprofit decision makers. Specifically, an improvement of service quality increases the consumption level of beneficiaries and, hence, reduces inequity. In contrast, an enlargement of the target group reduces the inequity for additional recipients. In both cases the entrepreneur benefits through a reduction of her disutility from inequity. Finally, the composition of recipients enters the decision calculus through the marginal disutility of inequity. With increasing (decreasing) marginal disutility the entrepreneur prefers to reduce a given amount of inequity of a poorer (wealthier) individual.

We find that weakly inequity-averse entrepreneurs choose to provide wealthier individuals at high social reference quality. In contrast, highly inequity-averse entrepreneurs care for the poorest individuals but offer minimum quality. These results allow for two explanations of the low quality of services to the very poor. First, the goods or services considered in these studies were provided by highly inequity-averse entrepreneurs and/or, second, they were supplied by weakly inequity-averse entrepreneurs applying a low subjective reference quality. Whether social entrepreneurs apply subjective reference levels or rather a societally standardized norm remains an empirical question.

As a further result, we show that the quantity of supplied individuals depends on the curvature of the budget function. Given convexity (concavity), highly (weakly) inequity-averse entrepreneurs serve the maximum number of needy people. Moreover, we find that entrepreneurs react differently with regard to variations in donations and input costs. Irrespective of the considered variation, entrepreneurs with low aversion never change the quality of the social good. In contrast, entrepreneurs with high aversion improve quality if additional funds are available, and they lower quality when inputs used for production become more expensive. Common to both types of decision makers is the provision of more individuals if donations increase. However, given a sufficiently high increase in input costs, highly inequity-averse entrepreneurs do not change the target group while weakly inequity-averse entrepreneurs serve a completely different (viz. wealthier) group.

Our results yield implications for stakeholders of nonprofit organizations whose objectives are related to quality, quantity and the composition of recipients. More specifically, donors or governments aiming at maximizing the number of served individuals with given funds should fund entrepreneurs who focus on the poorest people, if the majority of needy individuals is relatively poor (suggesting a convex budget-function in the model). In contrast, stakeholders generally interested in minimizing the number of needy individuals, through a provision of maximum service quality, should support entrepreneurs serving less poor individuals. Those stakeholders do not even need to change their contribution if input costs increase.

2.3.4 APPENDIX: PROOF OF PROPOSITIONS 2.6-2.10

Proof of Proposition 2.6. For notational clarity, we temporarily expand the term $U(c,\overline{n},\underline{n}(c,\overline{n}))$ to $U(c,\overline{n},\underline{n}(c,\overline{n});\alpha)$ to emphasize the influence of the entrepreneur's inequity aversion. However, we simplify the explicit notation by use of U .

By inserting user-fee revenues (2.14) into nonprofit-condition (2.15) and applying the implicit function theorem, one obtains the partial dependencies $d\bar{n}/dc = -[\bar{n} - \underline{n}(c,\bar{n})]/[c - b(\bar{n})] < 0$, $d\underline{n}(c,\bar{n})/dc = [\bar{n} - \underline{n}(c,\bar{n})]/[c - b(\underline{n}(c,\bar{n}))] > 0$ and $d\underline{n}(c,\bar{n})/d\bar{n} = [c - b(\bar{n})]/[c - b(\underline{n}(c,\bar{n}))] > 1$. Given that $\underline{n}(c,\bar{n})$ is constant, the social entrepreneur increases c at the cost of $\bar{n}$, or vice versa, if her total utility level is increased. She leaves both decision variables unchanged if the utility maximum is reached. Equivalent considerations apply for the pairwise variations of c and $\underline{n}(c,\bar{n})$, while keeping $\bar{n}$ constant, as well as $\bar{n}$ and $\underline{n}(c,\bar{n})$, with c constant.

Consider the variation of c and $\bar{n}$ for a constant $\underline{n}(c,\bar{n})$. The corresponding condition for marginal utilities can be written as

(A.2.3) $$\frac{\partial U}{\partial c} \overset{>}{\underset{<}{=}} \left| \frac{\partial U}{\partial \bar{n}} \cdot \frac{d\bar{n}}{dc} \right|.$$

Specifically, the entrepreneur increases (decreases) c and likewise decreases (increases) $\bar{n}$ if (A.2.3) holds with > (<). Both variables are left unchanged if (A.2.3) holds with equality. Inserting the partial derivatives into condition (A.2.3) and rearranging it yields

(A.2.4) $$\alpha \overset{>}{\underset{<}{=}} \frac{[b_{sr} - b(\bar{n})] \cdot [(b_{sr} - b(\bar{n}))/(b_{sr} - c)]^{\alpha - 1} - (b_{sr} - c)}{[b_{sr} - b(\bar{n})] - (b_{sr} - c)}.$$

As a first result, condition (A.2.4) holds with equality for $\alpha = 0$ and $\alpha = 1$. Since any entrepreneur with $\alpha = 0$ draws no utility from and, hence, does not engage in the allocation of the social good, an interior utility maximum is solely given for $\alpha = 1$. Furthermore, the right term of condition (A.2.4) is convexly increasing in α. Combining the two results gives $\partial U/\partial c > |(\partial U/\partial \bar{n}) \cdot (d\bar{n}/dc)|$, if $\alpha \in (0,1)$, $\partial U/\partial c = |(\partial U/\partial \bar{n}) \cdot (d\bar{n}/dc)|$, if $\alpha = 1$, and $\partial U/\partial c < |[\partial U/\partial \bar{n}] \cdot (d\bar{n}/dc)|$, if $\alpha \in (1,\infty)$.

The same reasoning applies to the pairwise variation of c and $\underline{n}(c,\bar{n})$ for a constant $\bar{n}$. Formulating the condition on marginal utilities yields

(A.2.5) $$\frac{\partial U}{\partial c} \overset{>}{\underset{<}{=}} \left| \frac{\partial U}{\partial \underline{n}(c,\bar{n})} \cdot \frac{d\underline{n}(c,\bar{n})}{dc} \right|.$$

Its rearrangement gives a similar expression as shown in condition (A.2.4):

(A.2.6) $$\alpha \gtreqless \frac{[b_{sr} - b(\underline{n}(c,\bar{n}))] \cdot [(b_{sr} - b(\underline{n}(c,\bar{n})))/(b_{sr} - c)]^{\alpha-1} - (b_{sr} - c)}{[b_{sr} - b(\underline{n}(c,\bar{n}))] - (b_{sr} - c)}.$$

Again, condition (A.2.6) holds with equality for $\alpha = 0$ and $\alpha = 1$ and its right term is convexly increasing in α. Hence, $\partial U/\partial c > \|[\partial U/\partial \underline{n}(c,\bar{n})] \cdot [d\underline{n}(c,\bar{n})/dc]\|$ if $\alpha \in (0,1)$, $\partial U/\partial c = \|[\partial U/\partial \underline{n}(c,\bar{n})] \cdot [d\underline{n}(c,\bar{n})/dc]\|$ if $\alpha = 1$, and $\partial U/\partial c < \|[\partial U/\partial \underline{n}(c,\bar{n})] \cdot [d\underline{n}(c,\bar{n})/dc]\|$ if $\alpha \in (1,\infty)$.

Finally, consider the pairwise variation of $\bar{n}$ and $\underline{n}(c,\bar{n})$ for a constant c. Here, the condition on marginal utilities is written as

(A.2.7) $$\frac{\partial U}{\partial \bar{n}} \gtreqless \left| \frac{\partial U}{\partial \underline{n}(c,\bar{n})} \cdot \frac{d\underline{n}(c,\bar{n})}{d\bar{n}} \right|,$$

or, equivalently,

(A.2.8) $$x(\varphi,\alpha) := \frac{[b_{sr} - b(\underline{n}(c,\bar{n})) + \varphi]^{\alpha} - (b_{sr} - c)^{\alpha}}{c - b(\underline{n}(c,\bar{n})) + \varphi} \gtreqless \frac{\left[(b_{sr} - b(\underline{n}(c,\bar{n})))^{\alpha} - (b_{sr} - c)^{\alpha}\right]}{c - b(\underline{n}(c,\bar{n}))},$$

with $\varphi := b(\underline{n}(c,\bar{n})) - b(\bar{n}) > 0$ and

$$\frac{\partial x(\varphi,\alpha)}{\partial \varphi} = \frac{[b_{sr} - b(\underline{n}(c,\bar{n})) + \varphi]^{\alpha-1}}{(c - b(\underline{n}(c,\bar{n})) + \varphi)^2} \cdot \hat{x}(\alpha) \gtreqless 0,$$

with $\hat{x}(\alpha) := \alpha \cdot [c - b(\underline{n}(c,\bar{n})) + \varphi] - [b_{sr} - b(\underline{n}(c,\bar{n})) + \varphi] + (b_{sr} - c) \cdot \left(\frac{b_{sr} - c}{b_{sr} - b(\underline{n}(c,\bar{n})) + \varphi} \right)^{\alpha-1}$.

For $\alpha = 0$ and $\alpha = 1$, condition (A.2.8) holds with equality and $\hat{x}(\alpha) = 0$ and, hence, $\partial x(\varphi,\alpha)/\partial \varphi = 0$. For $\alpha \neq \{0,1\}$, $\partial x(\varphi,\alpha)/\partial \varphi$ and $d\hat{x}(\alpha)/d\alpha$ are indeterminate. However, since $d^2\hat{x}(\alpha)/d\alpha^2 > 0$, it follows that $\partial x(\varphi,\alpha)/\partial \varphi < 0$ and, hence, $\partial U/\partial \bar{n} < \|[\partial U/\partial \underline{n}(c,\bar{n})] \cdot (d\underline{n}(c,\bar{n})/d\bar{n})\|$ if $\alpha \in (0,1)$. $\partial U/\partial \bar{n} = \|[\partial U/\partial \underline{n}(c,\bar{n})] \cdot (d\underline{n}(c,\bar{n})/d\bar{n})\|$ if $\alpha = 1$. Finally, $\partial x(\varphi,\alpha)/\partial \varphi > 0$ and $\partial U/\partial \bar{n} > \|[\partial U/\partial \underline{n}(c,\bar{n})] \cdot (d\underline{n}(c,\bar{n})/d\bar{n})\|$ if $\alpha \in (1,\infty)$.

The results of the pairwise comparisons show that, for any given α, the ordering of marginal utilities is independent of the levels of c, $\overline{n}$, and $\underline{n}(c,\overline{n})$. Hence, with exception of the special case $\alpha = 1$, the social entrepreneur directly or indirectly chooses the maximum levels of those two variables that show the highest marginal utility. Thus, combining the previous results, one obtains

$$\frac{\partial U}{\partial c} > \left|\frac{\partial U}{\partial \overline{n}} \cdot \frac{d\overline{n}}{dc}\right| \text{ and } \frac{\partial U}{\partial \overline{n}} < \left|\frac{\partial U}{\partial \underline{n}(c,\overline{n})} \cdot \frac{d\underline{n}(c,\overline{n})}{d\overline{n}}\right| \text{ if } \alpha \in (0,1),$$

$$\frac{\partial U}{\partial c} = \left|\frac{\partial U}{\partial \overline{n}} \cdot \frac{d\overline{n}}{dc}\right| = \left|\frac{\partial U}{\partial \underline{n}(c,\overline{n})} \cdot \frac{d\underline{n}(c,\overline{n})}{dc}\right| \text{ if } \alpha = 1, \text{ and}$$

$$\frac{\partial U}{\partial \overline{n}} > \left|\frac{\partial U}{\partial \underline{n}(c,\overline{n})} \cdot \frac{d\underline{n}(c,\overline{n})}{d\overline{n}}\right| \text{ and } \frac{\partial U}{\partial c} < \left|\frac{\partial U}{\partial \underline{n}(c,\overline{n})} \cdot \frac{d\underline{n}(c,\overline{n})}{dc}\right| \text{ if } \alpha \in (1,\infty).$$

Consequently, $c^* = b_{sr}$ and $\underline{n}(c^*,\overline{n}^*) = n_{min}$ if $\alpha \in (0,1)$, c^* and $\overline{n}^*$ can adopt any values that satisfy nonprofit-condition (2.15) if $\alpha = 1$, and $c^* = b(\underline{n}(c^*,\overline{n}^*))$ and $\overline{n}^* = n_{max}$ if $\alpha \in (1,\infty)$. **Q.e.d.**

Proof of Proposition 2.7. Let l index the optimal choices for $\alpha \in (0,1)$ and h for $\alpha \in (1,\infty)$. The maximum quantity of recipients is given if the average subsidy margin to served individuals, $c - \int_{\underline{n}(c,\overline{n})}^{\overline{n}} b(n)dn \Big/ [\overline{n} - \underline{n}(c,\overline{n})]$, is minimal. Since $db(n)/dn < 0$ and c^* is constant for all $n \in [\underline{n}(c^*,\overline{n}^*),\overline{n}^*]$, a minimum average margin implies non-subsidization of the marginally wealthiest recipient, i.e.

$$\text{(A.2.9)} \quad c^* - b(\underline{n}(c^*,\overline{n}^*)) = 0,$$

which is, following the proof of proposition 2.6, fulfilled for $\alpha \neq 1$. Furthermore, for any two pairs c_i^*, $\overline{n}_i^*$ and c_j^*, $\overline{n}_j^*$ fulfilling (A.2.9) and with $c_i^* > c_j^*$ and for all $\mu \in (0, n_{max} - \underline{n}(c_j^*,\overline{n}_j^*)]$, it holds that

$$\text{(A.2.10)} \quad c_i^* - b(\underline{n}(c_i^*,\overline{n}_i^*) + \mu) \overset{>}{\underset{<}{=}} c_j^* - b(\underline{n}(c_j^*,\overline{n}_j^*) + \mu) \quad \text{if} \quad d^2b(n)/dn^2 \overset{>}{\underset{<}{=}} 0.$$

Consequently, if $d^2b(n)/dn^2 > 0$, then the average individual subsidy margin is minimal for the choices c_h^* and $\bar{n}_h^* (= n_{max})$ which implies the maximum quantity of served individuals $n_{max} - \underline{n}(c_h^*, n_{max})$. In contrast, if $d^2b(n)/dn^2 < 0$ then the choices $c_l^* (= b_{sr})$ and $\bar{n}_l^*$ imply the maximum quantity of recipients $\bar{n}_l^* - \underline{n}(b_{sr}, \bar{n}_l^*)$. Finally, if $d^2b(n)/dn^2 = 0$, then we have $n_{max} - \underline{n}(c_h^*, n_{max}) = \bar{n}_l^* - \underline{n}(b_{sr}, \bar{n}_l^*)$. **Q.e.d.**

Proof of Proposition 2.8. From the proof of proposition 2.6, the order of the marginal utilities of c, $\bar{n}$, and $\underline{n}(c, \bar{n})$, as given in (A.2.4), (A.2.6), and (A.2.8), is uniquely determined by α, and consequently independent of D. Thus, for $\alpha \in (0,1)$ an increase in D leads to $c^{D*} = c^* = b_{sr}$ and $\underline{n}(c^{D*}, \bar{n}^{D*}) = \underline{n}(c^*, \bar{n}^*) = n_{min}$. Given these values, nonprofit-condition (2.15) is fulfilled if $\bar{n}^{D*} > \bar{n}^*$ which implies $\bar{n}^{D*} - \underline{n}(c^{D*}, \bar{n}^{D*}) > \bar{n}^* - \underline{n}(c^*, \bar{n}^*)$. In contrast, for $\alpha \in (1, \infty)$ the entrepreneur chooses $\bar{n}^{D*} = \bar{n}^* = n_{max}$ and $c^{D*} = b(\underline{n}(c^{D*}, \bar{n}^{D*}))$ which implies $c^{D*} > c^*$ and $\underline{n}(c^{D*}, \bar{n}^{D*}) < \underline{n}(c^*, \bar{n}^*)$ and, hence, $\bar{n}^{D*} - \underline{n}(c^{D*}, \bar{n}^{D*}) > \bar{n}^* - \underline{n}(c^*, \bar{n}^*)$. **Q.e.d.**

Proof of Proposition 2.9. In the proof of proposition 2.6 we showed that the order of the marginal utilities of c, $\bar{n}$, and $\underline{n}(c, \bar{n})$, as given in equations (A.2.4), (A.2.6), and (A.2.8), is uniquely determined by α, and hence independent of b_{sr}. Thus, for $\alpha \in (0,1)$ an increase in input costs, i.e. an increase in b_{sr}, leads to $c^{I*} = b_{sr}^I$ and $\underline{n}(c^{I*}, \bar{n}^{I*}) = n_{min}^I$. In contrast, for $\alpha \in (1, \infty)$ we obtain $\bar{n}^{I*} = n_{max}$ and $c^{I*} = c^*$, which implies a decrease in social-good quality. **Q.e.d.**

Proof of Proposition 2.10. The proof of proposition 2.7 shows that the quantity of recipients is negatively correlated to the average subsidy margin $c - \int_{\underline{n}(c,\bar{n})}^{\bar{n}} b(n)dn \Big/ [\bar{n} - \underline{n}(c, \bar{n})]$ to served individuals. Since, according to proposition 2.9, condition (A.2.9) is still fulfilled after input costs rise, i.e. $c^{I*} - b(\underline{n}(c^{I*}, \bar{n}^{I*})) = 0$, differences in the average subsidy margin between the two states are uniquely determined by the sign of $d^2b(n)/dn^2$. With $c_i^* = c^{I*}$, $\bar{n}_i^* = \bar{n}^{I*}$, $c_j^* = c^*$, and $\bar{n}_j^* = \bar{n}^*$ and, hence,

$\mu \in \left(0, n_{max} - \underline{n}\left(c^{*}, \overline{n}^{*}\right)\right]$, it follows by condition (A.2.10) that if $d^{2}b(n)/dn^{2} < 0$ then the average individual subsidy margin is smaller for the choices c^{I*} and $\overline{n}^{I*}$ which implies $\overline{n}^{I*} - \underline{n}\left(c^{I*}, \overline{n}^{I*}\right) > \overline{n}^{*} - \underline{n}\left(c^{*}, \overline{n}^{*}\right)$. In contrast, if $d^{2}b(n)/dn^{2} > 0$ then $\overline{n}^{I*} - \underline{n}\left(c^{I*}, \overline{n}^{I*}\right) < \overline{n}^{*} - \underline{n}\left(c^{*}, \overline{n}^{*}\right)$. Finally, if $d^{2}b(n)/dn^{2} = 0$ then we have $\overline{n}^{I*} - \underline{n}\left(c^{I*}, \overline{n}^{I*}\right) = \overline{n}^{*} - \underline{n}\left(c^{*}, \overline{n}^{*}\right)$. **Q.e.d.**

2.4 IMPLICATIONS FOR FUTURE RESEARCH

As argued in the previous sections, by incorporating the motive of inequity aversion into the objective function, we obtain an intuitive explanation of how social entrepreneurs trade off the level of neediness, the quantity of recipients, and the quality of the social good. We therefore close a gap in the literature on the rationing behaviour of nonprofit organizations, which does not provide an adequate motivation applicable to the field of poverty alleviation. Additionally, we contribute to two important issues posed in the entrepreneurship literature. First, we foster an understanding of motivational differences between social and commercial entrepreneurs. While the latter type of founder is generally considered as profit maximizing, a characterization of social entrepreneurs has mainly concentrated on necessary capabilities and activities. Second, future research on the design of nonprofits should be oriented toward optimal inequity reduction. Hence, the work should focus on an improvement of methods for detection and quantification of existing inequality, i.e. opportunity identification, and on the design of business models for its effective elimination.

As a first indication that social entrepreneurs indeed act inequity averse, we are able to explain allocations that correspond to the evidence pinpointed in the introduction. However, since this evidence has only anecdotal character, there is need for more rigorous empirical confirmation of the models' assumptions and predictions. In this respect, experiments might prove adequate since the entrepreneurial allocation of external funds via social goods is similar to the distribution decisions typically analyzed in the corresponding literature.

The analytical framework developed in this chapter constitutes a basis for analyzing additional issues of social entrepreneurial behavior. Specifically, it merits investigation of how the different allocation patterns change if stakeholders exert an influence on the social entrepreneur's decision, which has been neglected so far. Especially, so-called lead donors, typically granting a significant and often the largest part of the initial financial need of nonprofit organizations, might wish to regulate if the entrepreneurial behaviour inadequately reflects their own objectives. However, the possibilities to regulate are limited since the social entrepreneur is generally better informed about the allocation (e.g. production costs or income of the target group) than the lead donor. This informational advantage might be due to geographic distances or a limited experience of the donor to assess social work.

A second group of stakeholders that might exert influence on the entrepreneur's allocation are volunteers. It can be expected that they participate in the organization, if their personal goals match the entrepreneurial mission.[64] The more the objectives of both individuals deviate, the less effective working time is likely to be devoted by the volunteer. In the extreme case, the volunteer refrains from any cooperation. Given that the availability of the total voluntary work differs across combinations of target group and social-good quality, the entrepreneur faces the trade-off between departing from her own preferred allocation and forgoing voluntary work. In this respect, the influence of volunteers could cause deviations from the characterized allocations.

Furthermore, our proposed models represent starting points for investigating a legal framework that optimally supports social entrepreneurship. In particular, extensions of the models would allow one to analyze the social entrepreneur's reactions to public policies relevant to her set of alternatives. On the one hand, social entrepreneurs are directly impacted by governmental grants, taxation, or other nonfinancial regulations. Public policies also affect the nonprofit organization indirectly if they are aimed at for-profit businesses of the same industry. As we have argued in section 2.3, social entrepreneurs are restricted in setting prices since needy individuals can purchase a good of identical quality from for-profit businesses. Hence, any public policy that affects the competitive behaviour

[64] Besley and Ghatak (2005) argue that a matching of the nonprofit's mission with the preferences of workers increases their efforts and, hence, the organizational efficiency.

of commercial firms also exerts an indirect effect on the nonprofit's set of alternatives. On the other hand, this set is even affected by policies that change the income structure of needy individuals, e.g. transfers, income taxation, or labour market regulations. Moreover, the studies of governmental policies might also contribute to the discussion related to figure 2.2 in the introductory section. Since regulations differ between countries, the analysis could explain observable differences in the composition of nonprofit income sources.

Finally, it should be noted that the presented analysis is only restricted to the field of poverty alleviation. It remains to be investigated to what extent the motive of inequity aversion explains social entrepreneurial behavior in other activities. Although insufficient income of people might not be the main determinant of opportunities in those fields, other forms of inequality could be relevant, such as inequitable allocations of political or human rights, mental or physical capabilities, or cultural goods.

3 FEDERAL LENDING PROGRAMS

3.1 INTRODUCTION[65]

Entrepreneurs are frequently restricted by external financiers in exploiting their innovative ideas, which critics typically attribute to unfavorable financing conditions or access barriers to outside capital.[66] Governments oppose these identified malfunctions by intervening in credit markets. In most cases the presumption of asymmetric information between borrower and debtor serves as the basis for evaluating the impact of federal initiatives on the allocation of credit.[67] In contrast, some authors have analyzed governmental policies by assuming symmetric information in the credit market. They justify governmental initiatives with positive externalities, incompletely competitive markets, and regulative intentions.[68]

In this chapter we take the view of symmetrically distributed information between lender and borrower. We find this assumption plausible for two reasons. On the one hand, Stiglitz and Weiss (1981) show that asymmetric information results in equilibrium credit rationing. However, several authors found this phenomenon not to be empirically significant which questions the presence of asymmetric information.[69] On the other hand, increased banking competition and the second Basel-Accord set an incentive for banks to improve their credit rating systems enabling them to identify debtors' probability of default more clearly.[70] Treacy and Carey (2000) analyze the internal rating systems at the 50 largest US banking organizations and find that a development along this line has been taken place since 1990 and "promises to continue to grow". In the course of this

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[65] With little modification, this chapter is taken from Raith et al. (2006).

[66] Holtz-Eakin et al. (1994), Blanchflower and Oswald (1998), and quite recently Buera (2009) empirically confirm the existence of capital constraints.

[67] Examples are Smith (1983), Mankiw (1986), Smith and Stutzer (1989), Gale (1990), Innes (1991), Lacker (1994), Williamson (1994), and Parker (2002), who provide theoretical frameworks to evaluate the effectiveness of federal credit programs in coping with market imperfections. By additionally drawing on empirical data, Gale (1991) shows serious inefficiencies of those governmental interventions.

[68] See, for example, Penner and Silber (1973) or Lombra and Wasylenko (1984). Mayshar (1977) explains the subsidization of risky private projects with the incompleteness of the capital market and the existence of an income taxation system.

[69] Compare Berger and Udell (1992), Levenson and Willard (2000), and Cressy and Toivanen (2001).

[70] Jankowitsch et al. (2007) provide evidence for the magnitude of this incentive. Their results indicate that the improvement of a rating system from low to medium accuracy can increase the annual rate of return on a portfolio by 30-40 bp.

development credit scoring techniques and private information exchanges have become increasingly important.[71]

Whereas credit rationing may call for federal credit programs in markets with asymmetric information, we justify governmental intervention here with the occurrence of positive externalities. Projects fail to be executed, because the private rate of return falls short of financing costs, even though the project is socially desirable. Especially innovative investment projects may feature social benefits that exceed their corresponding private rents. The reluctance of external sources to finance these ventures then leads to market failure. The credit market fails because the social benefit, as a result of project realization, is not included in the decision calculus of market participants.[72] In their empirical assessment of industrial innovations Mansfield et al. (1977) find that "in about 30 percent of the cases, the private return was so low that no firm, with the advantage of hindsight, would have invested in the innovation, but the social rate of return from the innovation was so high that, from society's point of view, the investment was well worthwhile."[73] In these cases governmental intervention would not only be desirable for entrepreneurs, but also socially legitimate.

Our objective with the current analysis is to examine the conditions for optimal lending structures. The deduction of properties for the optimal design of federal credit programs requires, in a first step, the determination of federal lending objectives. We, therefore, compare the objectives of a sample of governmental institutions and programs. From this comparison three fundamental goals can be determined: (1) Correction of market failure, (2) compliance with the subsidiarity principle, and (3) efficient employment of means.

We evaluate the achievement of the three identified objectives by means of a general credit-market model embedded in an interest-rate-risk-space. We choose this framework

[71] Frame et al. (2001) show empirically that credit scoring, as an automated underwriting technique, reduces information asymmetry between borrowing small businesses and their lenders. Kallberg and Udell (2003) find similar results for private information exchanges by using data from Dun & Bradstreet.

[72] Our argumentation of market failure follows the definition given in Arrow (1962), who argues that the deviation of the investors' return from the social benefit induces them to underinvest in R&D activities. As a modification, we assume that entrepreneurs refrain from launching innovative projects.

[73] Mansfield et al. (1977) find a median social return rate of 56 percent compared to a median private rate of 25 percent within their 17 case studies. Further results can be found in Griliches (1992), who gives an overview of alternative R&D-models and emphasizes that, for all of these models, social rates of return lie significantly above the corresponding private rates.

for policy evaluation because we believe that most federal lending activities can be reduced to the use of either risk-reduction or interest-rate-subsidization instruments. In particular, loan guarantees, as a risk-reduction tool, are probably the most frequently used instrument worldwide[74] with an improving effect on welfare figures. Riding and Haines (2001) and Craig et al. (2008) empirically verify a positive relationship between the level of guaranteed lending and employment. Bradshaw (2002) confirm this relationship and additionally find a net increase in tax revenues. Furthermore, Craig et al. (2007) provide evidence that guaranteed lending in a local market is positively related to per-capita income growth in that market.

We construct two alternative lending structures embodying either risk reduction or interest-rate-subsidization. We find that both instruments are potentially able to achieve the stated objectives, if certain principles are applied. First, federal institutions have to implement the so called *gap-lending principle*. In contrast to Chaney and Thakor (1985), our analysis reveals that the public promotion of entrepreneurial investment projects should concentrate on those investors that are not able to obtain the necessary financing from the credit market and, thus, belong to the market gap. Moreover, cost efficiency would require adjusting the subsidy margin to those loan costs that the borrower is not able to cover, or, in case of processing costs, to sacrifice this flexibility and grant fixed margins. Finally, we find that governmental lending programs can never achieve their goals when they are self-financed.[75]

In practice, even optimal lending structures are typically applied with restrictions. As examples we investigate the policies of two prominent institutions, namely the US American Small Business Administration (SBA) and the German Kreditanstalt für Wiederaufbau (KfW). Figure 3.1 depicts the total funding amount of both institutions between 2003 and 2009. Accordingly, the volumes developed quite differently. The SBA's gross approval amount peaked at $22.42 billion in 2004.[76] Since then, the volume had been

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[74] Beck et al. (2010) provide data on 76 partial guarantee schemes across 46 countries.
[75] Public lending institutions that implement self-financing programs try to cover their expenditures by charging participants a fee. Examples are the UK's Loan Guarantee Scheme (LGS) launched by the Department of Trade and Industry (see Cowling and Clay, 1995), the American SBA (see SBA, 2005) and the Canadian SBLA (see Riding, 1997).
[76] The data are taken from SBA (2010) and do not include the gross approval amount of the Disaster Program.

basically decreasing, with an acceleration in 2008, due to the global financial crisis. In contrast, the KfW expanded its promotional funding continuously (with exception of 2008) and reached a volume of €23.77 billion in 2009.[77] Although there might be other determinants of the contrary developments (e.g. the magnitude of market failure), the figure could indicate that both institutions apply different lending structures. Indeed, we find differences in the handling of the gap-lending principle, self-financing efforts and interest rate limitations. In both cases we find room for additional reform.

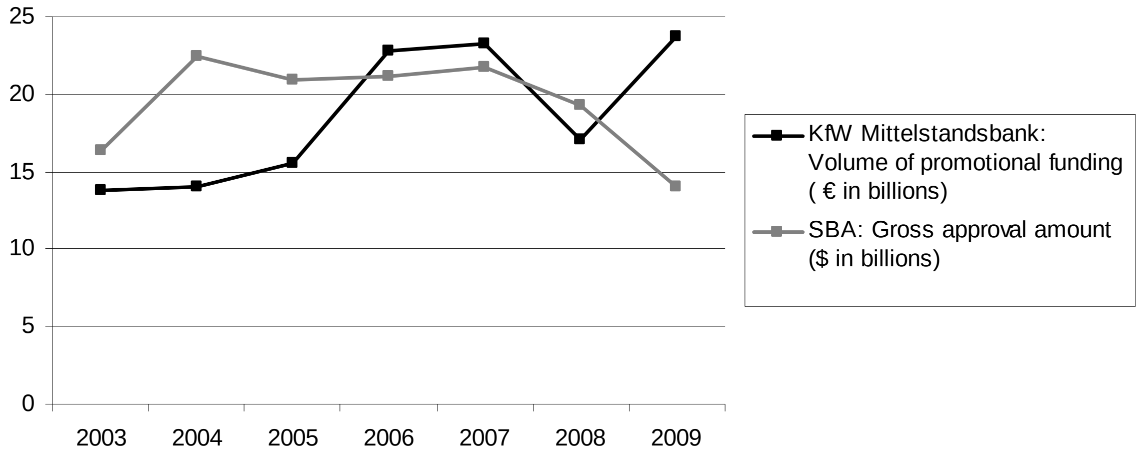

Figure 3.1: Comparison of the total funding volume of SBA and KfW between 2003 and 2009[78]

The rest of the chapter is organized as follows. In section 3.2 we deduce federal lending objectives from the statutes of selected governmental institutions. Section 3.3 introduces a general model of the credit market, which displays a market failure due to positive externalities. In sections 3.4 and 3.5 alternative lending structures are formulated as well as evaluated with respect to their goal achievement and the conditions for optimality are derived. In section 3.6 we apply this framework to the federal lending structures of the SBA and the KfW. Section 3.7 shows the stability of our results in a more general situation. We conclude in section 3.8 with an interpretation of our results and implications for future research.

[77] The data are taken from KfW Bankengruppe (2003, 2004a, 2005, 2007, and 2009).
[78] Source: Own illustration.

3.2 FEDERAL LENDING OBJECTIVES

The international comparison of federal lending institutions reveals three fundamental objectives that are consistently formulated for a large number of federal lending programs:[79]

Federal Lending Objectives
1. Correction of market failure 2. Compliance with the subsidiarity principle, i.e. ensuring competitive neutrality 3. Efficient use of means

The first objective is based on the assumption that there is some form of imperfection in the credit market and that it is the government's duty to correct the corresponding failure. For instance, small and medium-sized enterprises often receive less and smaller loans than public institutions find economically desirable. In terms of its strategic plan, the American SBA, thus, tries to "increase small business success by bridging competitive opportunity gaps facing entrepreneurs" and the Administration is, therefore, "continuing its efforts to bridge the gaps the market place does not address" (SBA, 2003). Accordingly, Rappaport and Wyatt (1990) speak of the SBA's "original goal of overcoming an imperfection in the business credit market." Analogously, Cowling and Clay (1995) state in their empirical study of the British Loan Guarantee Scheme (LGS) that "the Department of Trade and Industry launched the LGS with the intention of 'filling in' gaps in the availability of loan finance for SMEs in the UK." Likewise, the final report of the European MAP[80] points to "the importance of facilitating access to finance for SMEs […] through addressing well identified market gaps and/or failures."[81] Finally, Mann and Pöhler (2003) take a clear position towards the correction of market failures as a rationale for governmental intervention in German credit markets.

[79] The sample encompasses the following institutions and programs: the American SBA, the British LGS, the European MAP, and the German KfW whose programs additionally serve as patterns in (South-) East European countries to support their transition processes towards market economies.

[80] Multiannual Programme for Enterprise and Entrepreneurship, and in particular for small and medium-sized enterprises (SMEs) 2001-2005

[81] See Commission of the European Communities (2004).

The second objective of federal lending institutions is to comply with the subsidiarity principle which embodies the requirement for competitive neutrality between the federal agency and the private banking sector. Stated differently, credit-market interventions of the government must not create additional market distortions by substituting private banks' business. In his cross-country analysis Winkler (1999) claims that federal lending institutions, "by their very design, do not compete with commercial banks because they function solely as second-tier institutions. As a rule, a [federal agency] will not lend directly to the target group, but will channel funds to the final borrowers via local commercial banks and savings banks." The SBA as well as the KfW embedded this rule in their corporate laws. In the Small Business Act §7(a)(1)(A) the Administration states clearly that "no direct financing may be made unless it is shown that a participation [(i. e. guaranteed bank loan)] is not available."[82] The Law concerning the KfW (KfW Bankengruppe, 2004b) refers to this objective in §3(1): "In connection with the granting of financings […], credit institutions or other financing institutions must be involved […]. In carrying out its operations the Institution must respect with regard to credit institutions or financing institutions the principle of non-discrimination under European Community law."[83] Finally, the Commission of the European Communities (2004) confirms that the financial instruments applied under the MAP "operate on a commercial basis, and so do not entail market distortions," which could be generated by direct financing modes.

The third objective aims at minimizing the costs of lending institutions' operating activities. According to Cowling and Clay (1995), the British LGS was initiated to generate a "cost-effective job/wealth generation package." Analogously, the SBA seeks to "ensure that all SBA programs operate at maximum efficiency and effectiveness" (SBA, 2003). Efficiency is also emphasized by Reich (2002), who lists this objective explicitly for the KfW.

Although there are several other goals that may also be taken into account, the three fundamental objectives outlined above are shared by most federal lending institutions. In

[82] See also Riding and Haines (2001).
[83] This law also constitutes the basis for the KfW's outreaching activities to (South-)East European countries. Koehn and Erhardt (2004) speak of interventions "guided by the overarching principle of subsidiarity […] [and therefore] aim at strengthening local financial intermediaries instead of supporting parallel delivery structures."

the course of the subsequent analysis we suppose a hybrid federal agency which takes these three objectives as guidelines for policy formulation.

3.3 THE MODEL

The presence of asymmetric information is the most common explanation for credit rationing. Indeed, under information symmetry, it is difficult to justify – from the supply side – why some debtors are offered a private bank loan while others are not. Theoretically, every risk can be compensated by a payment of the respective risk margins.[84] Consequently, all applicants should be supplied with a loan by the banking sector.

Nevertheless, it can be observed that debtors are not always able to obtain funds, even when their risk properties can be revealed. We explain this phenomenon from the demand side: Suppose that all investors value projects by their expected private rates of return. Within each risk class there then exist investments, whose return rates exceed or fall short of the respective risk corresponding market interest rate. Those investors, whose projects feature expected returns that cannot cover the market price, refrain from demanding loans.

In order to construct a model which solely captures this feature, we assume that information between borrowers and debtors is distributed symmetrically, i. e., all investors are perfectly informed about federal and market loan conditions of the participating banks. Conversely, banks have full information concerning the risks and the expected internal return rates of the planned investments. Figure 3.2 depicts the credit market in terms of interest rate i and risk σ. Within this setting the perfectly competitive price-setting behavior of the private banking sector is represented by the market interest-rate curve $i^M(\sigma)$. This function is increasing in the borrower's risk level σ[85], due to the fact that

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[84] Saunders (1997) characterizes the composition of loan interest rates and identifies the credit risk premium as "the fundamental factor driving the promised return on a loan".

[85] We assume that the risk level σ of the projects accounts for an adjustment of collaterals. Specifically, by pledging collaterals, a borrower is able to reduce the remaining project risk to the bank, which, consequently, decreases the price of the loan according to the market interest-rate curve. For instance, if an investor's project possesses an initial risk level of 30 percent and the investor is able to cover 50 percent of the risk level by collaterals, the collateral adjusted risk level σ equals 15 percent. Since the market interest-rate curve is public information and we assume the investor to know the price decreasing effects of collaterals, he can therefore decide if applying for a loan is beneficial. In practice, the borrower receives the necessary

borrowers with higher risks must pay larger risk premiums in order to offset lower repayment probabilities. Without loss of generality, we assume that the $i^M(\sigma)$-curve has a linear form.[86]

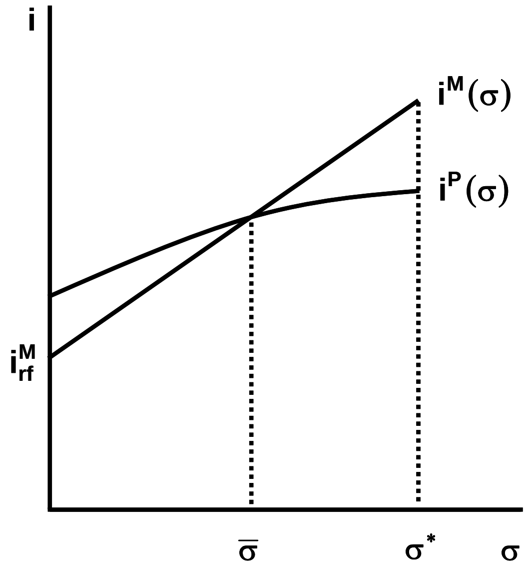

Figure 3.2: Market curve, private rate of return function and the loan gap

We focus our analysis on only those entrepreneurial investment projects which feature positive external effects, e. g. because of their innovative content.[87] As with the market rate, we characterize the *private* rate of return of socially desirable projects by an increasing function of the investment risk. In figure 3.2 the distribution of these projects is represented by the $i^P(\sigma)$-curve. Two features of the $i^P(\sigma)$-curve are crucial for our analysis: First, there are investments that obtain financing from the credit market, because

information from negotiations with banks. The inclusion of collaterals into the risk level simplifies the analysis, thus allowing us to avoid handling collaterals as an additional parameter within the model.

[86] The positive relationship between terms for bank loans and borrower risk defined by the banks' internal credit rating has been shown to be statistically significant by Machauer and Weber (1998). Although one might expect the $i^M(\sigma)$-curve to be convex, the exact shape crucially depends on how risk is measured. For instance, as long as risk is defined in rating terms, e. g. of Moody's or Standard & Poor's, the market interest-rate curve, indeed, has a convex shape. On the other hand, if risk is measured in terms of default probabilities, its shape is more likely to be concave. As can be seen later, our results are independent of the specific curvature.

[87] Innovating businesses are often the source of so-called R&D spillovers. New knowledge, which is generated within the business, is made public when the invention is offered to potential buyers. In this case, other market participants also benefit from the generated knowledge, but without having to discharge an adequate compensation. Consequently, the social rate of return, encompassing the businesses' as well as the other participants' surplus from that innovation, exceeds the private rate of return of the considered business.

$i^P(\sigma) \geq i^M(\sigma)$, but there are also projects with private rates that do not meet market conditions, i. e. where $i^P(\sigma) < i^M(\sigma)$. Second, the vertical distance between the $i^P(\sigma)$-curve and the $i^M(\sigma)$-curve varies for different projects. It is important to note that the results of our analysis can be derived for any distribution of eligible investment projects with these two features. We verify this claim in section 3.7 by explicitly acknowledging individual investment projects.

In figure 3.2 we denote the critical risk level where $i^P(\sigma) = i^M(\sigma)$ holds by $\overline{\sigma}$. In order to specify market failure, we presume for each considered investment project up to a certain risk level of $\sigma^* > \overline{\sigma}$ an expected social return rate which lies above the respective market interest rate[88]. By definition, σ^* denotes the risk level above which the social rate of return is lower than the market interest rate. Projects with higher risk levels should not be carried out, because their positive effects on the economy do not justify investment costs. Market failure is, therefore, given by the difference: $\sigma^* - \overline{\sigma}$. We refer to this difference as the *loan gap*. As can be seen from figure 3.2, the loan gap comprises all eligible investment projects lying below the market interest-rate curve. These projects are not carried out and market failure results. With this assumption, we explicitly presume that projects are indivisible and, hence, exclude so-called *bootstrapping* strategies, by which projects are started self-financed at low scale and then gradually grow through generated profits. Although this can help investors overcome the loan gap, it is not realistic for projects that are of interest to us here, which are characterized by a minimum capital requirement that is prohibitively high, e.g. high-tech start-ups.

The subsidiarity principle embodies the requirement for competitive neutrality between the federal agency and the private banking sector. In other words, credit-market activities of the public institution must not create additional market distortions by negatively affecting private banks’ business. The most common way to fulfill this principle is to allocate federal offerings indirectly through private banks. Under this procedure,

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[88] Griliches (1992) gives an extensive overview of attempts to measure the social rate of return. He argues, that in order to measure social returns directly “one has to assume either that their benefits are localized in a particular industry or range of products or that there are other ways of identifying the relevant channels of influence, that one can detect the path of spillovers in the sands of the data.” He emphasizes that all considered studies show social rates of return to be significantly above private rates.

private banks only grant loans voluntarily, if their incomes comply with laissez-faire market conditions. Consequently, public loan activities are blocked, if private banks are not compensated adequately. In the following, we focus on those lending structures which utilize this indirect lending procedure and, thus, satisfy the second federal lending objective.

The efficient use of means, as the third fundamental goal, will be measured in terms of the lowest possible costs for a given amount of internalized externalities. In order to evaluate federal credit programs from a cost perspective, we assume the number of projects in a certain risk class to be limited to one. Consequently, there exist exactly σ projects with a risk of at most σ in the modeled economy. This enables us to construct cost areas within our graphical model as the risk axis now also serves as a quantity axis.

3.4 ALTERNATIVE LENDING STRUCTURES

We evaluate alternative lending structures by explicitly focusing on two parameters: interest rates and risk levels. We justify this approach with the observation that public agencies essentially have two instruments to make investment projects marketable: interest rate subsidies and measures of risk reduction, e. g. the application of a guarantee rate, which we denote by γ.[89] In both cases governmental programs lead to a duality of market and federal loan prices. We denote the federal interest rates of publicly supported funds by $i^F(\sigma,\gamma)$, in contrast to the price of a market loan, $i^M(\sigma)$.

As a precondition for effectiveness, any federal lending structure must fulfill the participation constraints of credit market actors, which are given as follows: The borrower applies for a loan, if the project return is sufficiently large to cover his financing costs, i.e. $i^P(\sigma) \geq i^F(\sigma,\gamma)$. In contrast, the bank provides the loan, if it receives a return that equals at least the market price. In other words, the (direct or indirect) federal subsidy must be

[89] We follow the line of Penner and Silber (1973), who divide mortgage credit programs into first, policies designed to affect the interest rate paid by borrowers, without changing the risk characteristics, and second, programs designed to change the risk characteristics of mortgages, so that they become more desirable for lenders.

sufficiently large to cover the difference between the market interest rate $i^M(\sigma)$ and the premium that the bank receives from the investor $i^F(\sigma,\gamma)$.

For the subsequent analysis, we present two alternative federal credit programs, (a) and (b), where each employs one of the two policy instruments. Specifically, program (a) consists of a fixed guarantee rate and a market determined interest rate, whereas in program (b) the governmental institution subsidizes the market interest rate by a constant margin but without any guarantee support.

3.4.1 FIXED GUARANTEE RATE, MARKET DETERMINED INTEREST RATE

Within structure (a) the federal agency offers a guarantee rate of a fixed percentage $\gamma = \bar{\gamma} > 0$ to all investors, while letting the interest rate adjust to market price conditions, i.e. $i^F(\sigma,\gamma)\big|_{\gamma=0} = i^M(\sigma)$. The guarantee reduces the private banks' costs of credit risk, thus inducing them to lower the price for the guarantee complemented funds in a competitive market. As a consequence, lower risk premiums let investors' demand for conditioned federal loans rise. The implications of structure (a) are illustrated in figure 3.3. The market interest rate curve for guaranteed loans is denoted by $i^F(\sigma,\bar{\gamma})$. Since federal lending reduces the risk of financing a given project from σ to $(1-\bar{\gamma})\sigma$, the $i^F(\sigma,\bar{\gamma})$-curve results from a downward rotation of the $i^M(\sigma)$-curve at its ordinate intersection, i. e. the risk-free interest rate i^M_{rf}. Hence, public risk coverage rises with the level of risk.

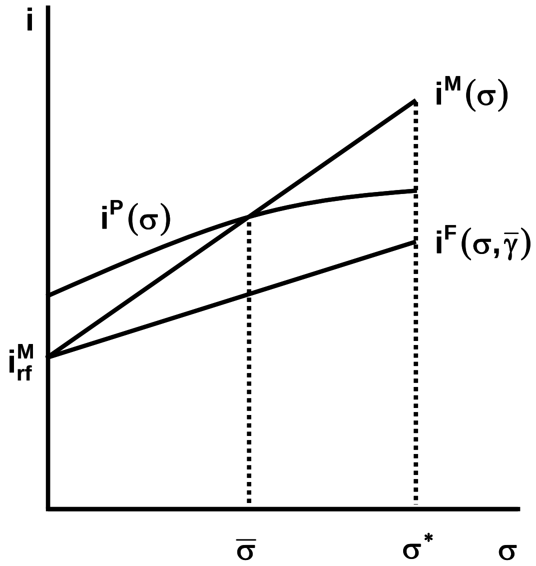


Figure 3.3: Fixed guarantee rate, market determined interest rate

3.4.2 FIXED INTEREST SUBSIDIZATION, NO GUARANTEE

Under structure (b) the federal agency offers loan endowments with a constant interest-rate subsidization, regardless of the project's risk $\left(i^F(\sigma,\gamma)\big|_{\gamma=0} < i^M(\sigma) \right)$. However, the agency refrains from warranting guarantees to private banks ($\gamma = 0$). This setting characterizes the current lending arrangement of the German KfW in a significant part of its programs. According to Stiglitz and Ellerman (2000) interest rate subsidies are also common in Ireland, Scotland and Wales. The qualitative outcome is the same as with structure (a), namely a subsidization of the private banks' cost structures. Consequently, the banking sector competes with loan prices until profit levels match the former market situation. Figure 3.4 shows the effect of structure (b) on the credit market. Graphically, the agency transfers the margin $i_{rf}^M - i_{rf}^F$ to the private bank, thus inducing a parallel downward shift of the $i^M(\sigma)$-curve. The subsidized interest rate curve $i^F(\sigma,0)$ now constitutes the new borrowers' market conditions.

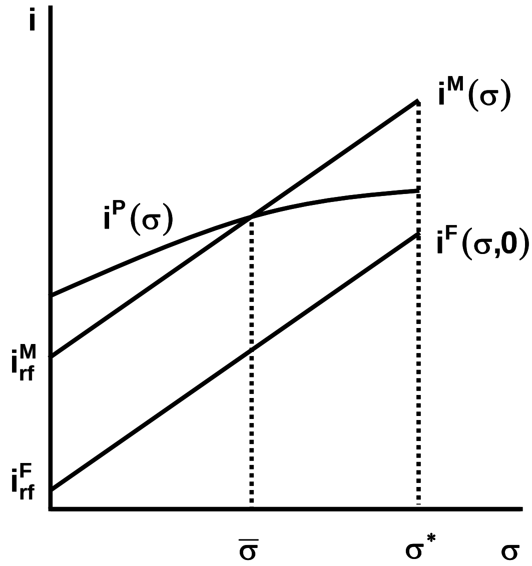


Figure 3.4: Fixed interest subsidization, no guarantee

3.5 OPTIMAL LENDING STRUCTURES

In order to compare the alternative lending structures, we assess their goal achievement given the three fundamental objectives, namely correction of market failure, compliance with the subsidiarity principle, and efficient use of means.

Complete market failure correction requires the following condition to hold:

(3.1) $i^F(\sigma,\gamma) \leq i^P(\sigma) \quad \forall \sigma \in [\overline{\sigma}, \sigma^*].$

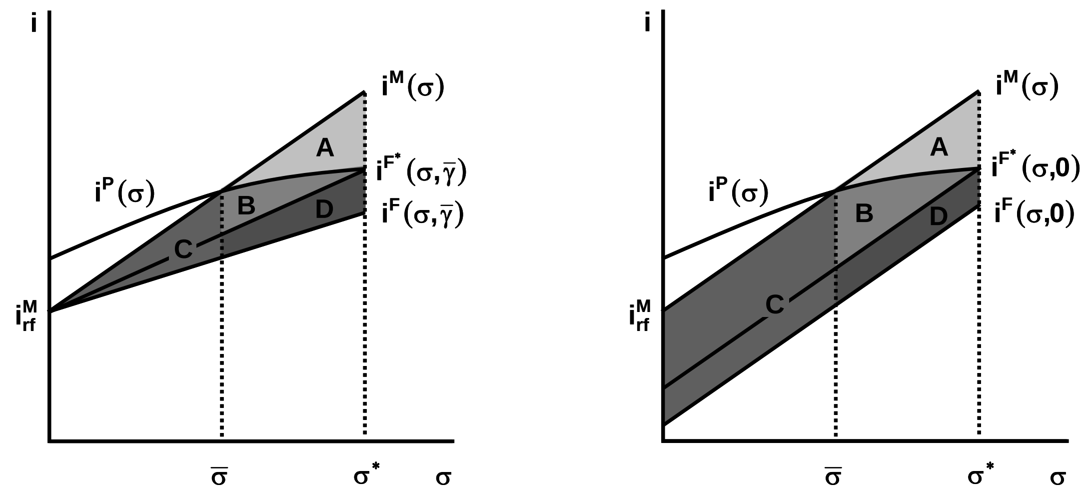
As one can verify from figures 3.3 and 3.4, in both scenarios described in the previous section, the federal agency achieves a complete market failure correction, provided subsidies are available and sufficiently large for all projects within the loan gap.[90] Independent of the respective policy, the interest rate that all loan-gap applicants discharge must be covered by the expected returns of their projects to ensure their participation in the federal lending program.

90 Note that, for $i^P(\sigma) < i^M_{rf}$, a market failure correction cannot be achieved by guarantees. Regardless of the guarantee in the contract, the private bank would always obtain an interest rate that falls short of the corresponding market interest rate.

By construction, both lending structures also comply with the subsidiarity principle. Note that market conditioned loans are fully crowded out by public loans, irrespective of the underlying risk properties. In other words, no applicant with a risk profile between 0 and σ^* demands a non-subsidized loan with a higher price. Nevertheless, the subsidiarity principle ensures that the private banking sector can distribute subsidized loans in a competitively neutral form.

In order to assess the efficient use of means of both alternative lending structures, the different costs of market failure correction are displayed by areas A, B, C, and D in panels (a) and (b) of figure 3.5, respectively. The two figures correspond to figures 3.3 and 3.4 of the preceding section. As a new element, figure 3.5 also features the $i^{F*}(\sigma,\gamma)$-curve which characterizes a cost minimal policy for the given lending structures of the preceding section. Efficiency is, therefore, reached when the subsidy level is set at the minimum level which is necessary to eliminate market failure. Mathematically, the $i^{F*}(\sigma,\gamma)$-curve is obtained from the following optimization problem:

(3.2) $$i^{F*}(\sigma,\gamma) = \arg\min_{i^F(\sigma,\gamma)} \int_{\bar{\sigma}}^{\sigma^*} \left[i^P(\sigma) - i^F(\sigma,\gamma) \right] d\sigma$$ subject to condition (3.1).



(a) Fixed guarantee rate, market interest rate (b) Fixed interest subsidization, no guarantee

Figure 3.5: The costs of alternative lending structures

For any lending structure, equation (3.2) describes the necessary condition to achieve an interior optimum. However, it does not question whether the structure itself is optimal. In panels (a) and (b) of figure 3.5 areas B, C, and D characterize the redistribution of capital from the agency to investors of all risk classes without any superior goal achievement, thus quantifying the inefficiencies of the individual lending structures. In contrast, area A represents costs that are necessary to correct the market failure. Under an optimal lending structure it is, therefore, sufficient to reimburse the private banking sector for only those costs that investors in the loan gap are not able to cover. In other words, investors should be obliged to carry credit costs up to the maximum amount $i^P(\sigma)$ that is covered by their project. For the federal interest rate this implies

(3.3) $i^{F*}(\sigma,\gamma)=i^P(\sigma) \qquad \forall\sigma\in[\bar{\sigma},\sigma*]$ and

$$i^{F*}(\sigma,\gamma)=i^M(\sigma) \qquad \forall\sigma\in[0,\bar{\sigma}).$$

Condition (3.3) requires the public agency to implement a federal interest rate for loan gap applicants which corresponds exactly to the respective private return rate of the project. To accomplish this, one option is to reimburse the private bank with a flexible interest margin. Alternatively, the agency could provide a flexible guarantee rate, which reduces any risk level $\sigma'\in[\bar{\sigma},\sigma^*]$ to a lower level σ'', in order to meet market conditions, where σ'' is related to σ' through the condition $i^M(\sigma'')=i^P(\sigma')$. The minimum costs that are necessary to correct market failure are then given by area A in figure 3.6.

Our result has two important implications. First, the federal agency must only promote those risky investments which belong to the loan gap, i. e. $\sigma'\in[\bar{\sigma},\sigma^*]$. Consequently, a cost-minimizing agency should act as a pure gap lender, if it wishes to avoid promoting projects, which would also be financed by the private banking sector without intervention. This implies that the lending structures discussed above both entail inefficiencies.

Second, market failure based on positive externalities cannot be corrected by a self-financing lending program. Any fee required to finance the subsidy margin can be interpreted as a reduction of the expected private rate of return, which by itself would already require a higher subsidy margin. By giving the fee back to investors in the form of

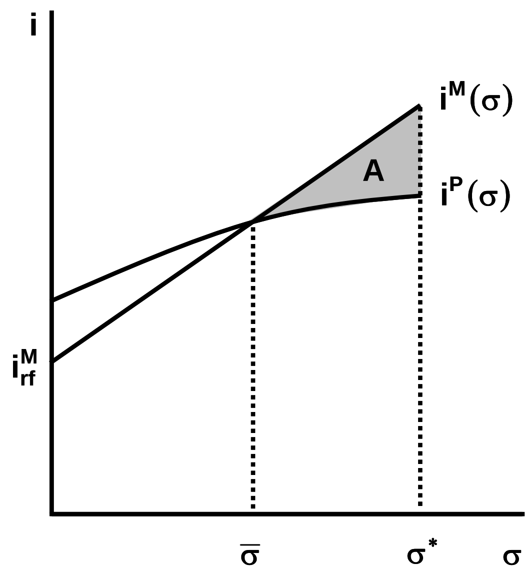


Figure 3.6: Minimal costs of the optimal lending structure

an interest-rate subsidy or a guarantee, the private rate of return could at best reach its initial level. Consequently, the costs of area A cannot be covered by investors, since they can afford to pay only $i^P(\sigma)$.[91]

In practice, however, processing costs arise, because the guarantee rate or, alternatively, the reimbursement interest margin must be adjusted to the characteristics of every specific project in order to achieve optimality. As long as processing costs are sufficiently large – at least as large as area B in figure 3.7 – the federal agency should either introduce a fixed guarantee rate (panel (a)) or a constant interest margin (panel (b)), while both should be available only for loan-gap applicants. The amount of the corresponding subsidy is given by the following optimization problem:

(3.4) $$i^{F*}(\sigma,\gamma) = \underset{i^F(\sigma,\gamma)}{\arg\min} \int_{\bar{\sigma}}^{\sigma^*} \left[i^P(\sigma) - i^F(\sigma,\gamma) \right] d\sigma$$

subject to condition (3.1) and $i^{F*}(\sigma,\gamma) = i^M(\sigma) \quad \forall \sigma \in [0,\bar{\sigma})$.

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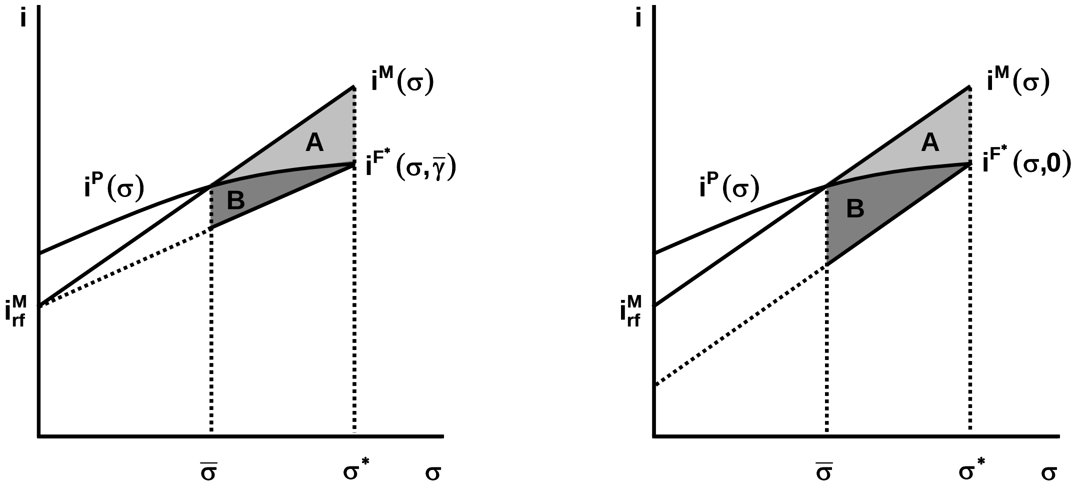
[91] The funds required to finance area A have to be taken from alternative sources, e.g. tax receipts. The government could try to raise taxes, in particular, in those areas where the innovative investment causes the strongest external effects, so that at least a partial internalization is achieved.



(a) Fixed guarantee rate, market interest rate (b) Fixed interest subsidization, no guarantee

Figure 3.7: Optimal lending structure in presence of processing costs

By fixing guarantee rates or interest-rate subsidies, minimum costs of the amount $A+B$ accrue when the gap-lending principle is applied.[92] In contrast, if policy instruments were risk-dependent, the $i^{F*}(\sigma,\gamma)$-curve could be adjusted flexibly to the $i^{P}(\sigma)$-curve. Specifically, optimality then requires the subsidy margin to be adjusted flexibly to the exact financial needs of the debtor (area A). The situation changes, though, when processing costs are taken into account. Programs with fixed spending margins then become optimal. Area B, thus, displays the additional costs of designing risk-independent promotional instruments.[93]

In contrast to areas A and B, which have a specific function in correcting market failure, areas C and D in figure 3.5 depict costs that are avoidable. Specifically, area C represents costs that arise from violating the gap-lending principle, i. e. expenditures from promoting projects that could just as well be served by the market. In contrast, area-D costs are related to loan-gap applicants, but they exceed the amount necessary to correct market failure, e. g. due to imprecise policy targeting. It should be noted, however, that the implementation of $i^{F*}(\sigma,\gamma)$ and, hence, the avoidance of these excess subsidies, requires

[92] It is important to note that the proposed model only allows for qualitative statements. Although area B is smaller in panel (a) compared to (b), it cannot be concluded that a fixed guarantee rate basically causes less costs.

[93] In practice, the additional expenditures of the amount B should be economically justified by the social rate of return of loan-gap projects.

exact knowledge of $i^P(\sigma)$. In practice, the acknowledgement of area-D costs, therefore, seems inevitable.

3.6 THE LENDING STRUCTURES OF THE SBA AND KFW

The lending structure with a fixed guarantee rate for loan gap applicants corresponds to the policy of the American SBA's 7(a) Loan Guarantee Program. To ensure that only the loan gap is filled, banks must verifiably deny a loan offer under market conditions – this is referred to as the *Credit Elsewhere Test* (SBA, 2004, §7.(a)(1)(A)): "CREDIT ELSEWHERE. - No financial assistance shall be extended pursuant to this subsection if the applicant can obtain credit elsewhere. […]"[94] Within our framework the institutional arrangement of the SBA is generally optimal, provided that processing costs are sufficiently large.

However, the SBA places two operational barriers on its program. First, "the SBA's legislative package includes language that will give the agency the authority to adjust the fees every year to keep the 7(a) program at a zero subsidy."[95] As the preceding analysis shows, a completely self-financing program can never correct market failure.[96] Second, the SBA places an upper limit, $\hat{i}$, on the interest rate charged by private banks when loans are complemented by federal guarantees.[97] Figure 3.8 depicts the impact of the SBA's practiced lending policy of a fixed guarantee rate and an interest-rate limitation.

Within the framework of our model, the interest-rate cap could again interfere with the SBA's objective of complete market failure correction. As long as the loan price limit $\hat{i}$ lies above $i^F(\sigma,\bar{\gamma})\ \ \forall\sigma\in\left[\bar{\sigma},\sigma^*\right]$, the interest-rate cap is ineffective and, thus, does not

[94] According to Riding and Haines (2001) lenders under the UK's Loan Guarantee Scheme must also certify to have denied applicants a conventional loan, due to lack of collateral. Hence, the UK's Department of Trade and Industry may also be considered as a gap lender. In contrast, Hatakeyama et al. (1997) state that "the credit guarantee corporations of Japan and the Korea Credit Guarantee Fund (KCGF) have set clear policies of extending guarantee services to any small entrepreneurs with good business reputation."

[95] See SBA (2005).

[96] As an example for the ineffectiveness of self-financing programs, Cowling (1998) analyses the attempts of the British LGS to avoid former losses by equalizing revenues and expenditures. In 1984, the increase of the guarantee premium from 3 to 5% and the reduction of the guarantee rate from 80 to 70% resulted in a dramatic fall of take-up rates from 1,600 to 40 loans per quarter.

[97] Interest-rate caps are common in other countries as well (Riding and Haines, 2001). For instance, the Canadian Small Business Loan Act (SBLA) limits the maximum mark-up on the risk-less market interest rate by 1.75 percent.

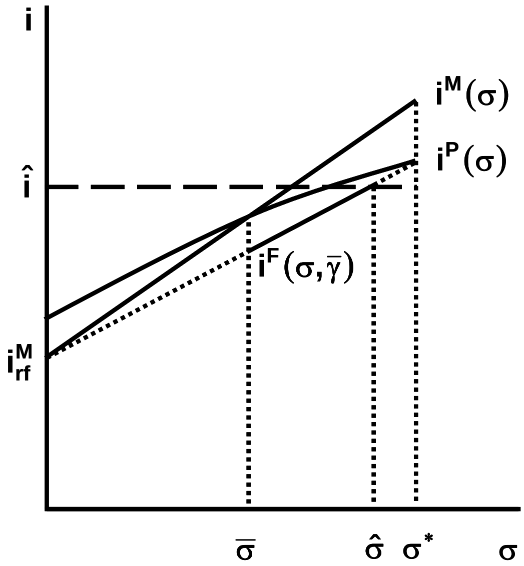


Figure 3.8: The lending policy of the SBA

hinder market failure correction. In this case, the SBA would, indeed, implement the optimal lending structure. On the other hand, if $i^F(\bar{\sigma},\bar{\gamma}) < \hat{i} < i^F(\sigma^*,\bar{\gamma})$, objective 1 is no longer met. For project risks above $\hat{\sigma}$[98] the interest-rate cap renders the private bank's compensation below market conditions and thus impedes its cooperation – this is the case illustrated in figure 3.8. In the worst case, $\hat{i}$ falls short of $i^F(\sigma,\bar{\gamma})\ \ \forall\sigma\in[\bar{\sigma},\sigma^*]$. As a consequence, the SBA cannot correct market failure with a fixed guarantee rate at all, and the market situation is the same as without governmental intervention. Since any effective interest-rate limitation below the $i^F(\sigma,\bar{\gamma})$-curve impedes market-failure correction, our analysis suggests that the SBA should operate without these additional restrictions.[99]

An alternative arrangement is implemented by the German KfW. According to §1a of the Law Concerning KfW (KfW Bankengruppe, 2004b), the German government guarantees all obligations of the federal agency entailing an AAA-refinancing status. These refinancing conditions have then been made available for private banks' federal loan transactions, resulting in an interest-rate subsidy margin. In April, 2005, the KfW transformed its lending structure by changing the mode of its loan price subsidization.

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98 $\hat{\sigma}$ can be obtained from the equation $\hat{i} = i^F(\hat{\sigma},\bar{\gamma})$.

99 In support of this conclusion, the European Commission (2003) argues that "for allowing the microcredit operator to be fully self-sustainable, the public authority could increase the ceiling of usury rate, in countries where such a rate is legally binding."

Under the new structure the institution switched from fixed to risk-dependent interest rates and abolished the warranting of guarantees. Nevertheless, similar to the SBA, the KfW continues to limit the price-setting scope for private banks by now administering interest-rate caps for every specially defined risk class.

Under the present KfW lending structure (figure 3.5, panel (b)) optimal lending is possible, in principle, given that processing costs are sufficiently large. Nevertheless, our analysis shows that two potential obstacles still need to be removed to ensure optimality. First, the KfW should refrain from offering its loan conditions to all eligible investors and, instead, focus on loan-gap applicants. Second, in line with our argument concerning the SBA, the KfW should abolish its interest-rate limitation.

3.7 GENERALIZATION OF THE MODEL

Our conclusions in the previous sections were all derived within the analytical framework based on the construction of the $i^P(\sigma)$-curve in figure 3.2. In this section we show how our results carry over to a more general situation, where socially desirable investments are scattered around the market interest-rate curve, instead of being allocated along a clearly defined $i^P(\sigma)$-curve. The significant difference between both approaches is given by diverging distributions of investment projects and, thereby, varying degrees of market failure.

In figure 3.2 the market failure is depicted on the risk axis by the risk interval, in which the $i^P(\sigma)$-curve falls short of the market interest-rate curve. In the more general setting, though, the market gap cannot be determined on the basis of risk levels alone. Moreover, in order to identify whether a particular investment project is situated below the market curve, additional knowledge of the private rate of return is required.

Without loss of generality, consider, for example, lending structure (b), depicted in figure 3.5, where the federal agency subsidizes the interest rate imposed on eligible projects by a constant amount. The associated costs, characterized by areas A, B, C, and D, can be represented in figure 3.9 by the vertical distances a, b, c, and d for three representative investment projects.

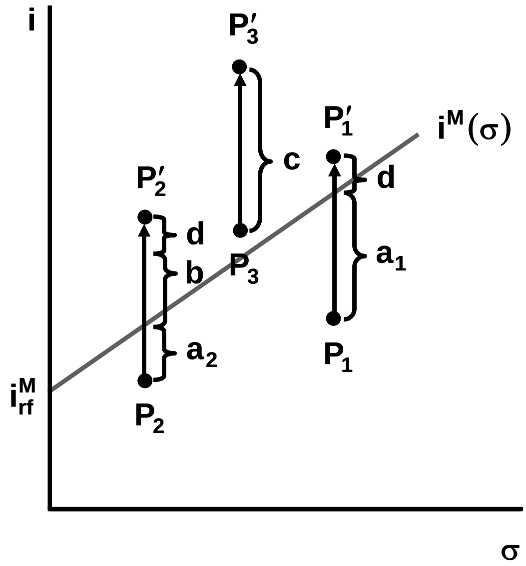

Figure 3.9: Transferability of derived results

The distance to the market interest rate curve is largest for project P_1, which we suppose represents the marginal project that the federal agency must promote in order to fully correct market failure. To make this project marketable a minimum subsidy of the amount a_1 is required. In practice, the actual reimbursement margin will presumably exceed the necessary minimum a_1, thus creating a slack which we denote by d.

Due to the policy of a constant subsidy margin, the same cumulative amount $a_1 + d$ must be granted to all projects. Therefore, consider next project P_2, another candidate for promotion. This investment could be subsidized with a minimum amount a_2, but the additional cost $b = a_1 - a_2$ arises, because of the non-risk adjusted constant subsidy margin. In addition, the slack d accrues here as well. Finally, consider project P_3, which normally should not be eligible for promotion under the gap-lending principle, since its private rate of return meets market requirements. Hence, federal funds spent on this project create costs of the amount c $(= a_1 + d = a_2 + b + d)$, which could also be avoided under an optimal lending structure.

3.8 CONCLUSION

Our objective in this chapter was to develop a general framework for evaluating alternative federal lending structures by means of an interest-rate-risk model and observable federal lending objectives. Our comparison reveals that federal credit programs are only efficient when they are designed as *gap-lending* structures. This entails the promotion of only those applicants that are not able to obtain financing from the credit market. Ideally, the subsidy margin should exactly reimburse the loan costs that investors are not able to pay themselves, i. e. the difference between market loan costs and the private rate of return. Since this requires a flexible subsidy margin that has to be adjusted to the project characteristics in each individual case, lending structures, which do not employ such flexible instruments, can never achieve optimality. As we pointed out, though, the adjustment of risk dependent instruments causes processing costs. Thus, with sufficiently high processing costs, the least expensive way of correcting market failure is to impose a constant subsidy margin over all projects. We also showed that every federal lending system which aims at correcting market failure, due to positive externalities, requires governmental cost contributions and, thus, cannot be self-financing. This result stands in line with the analyses of Gale (1990) and Williamson (1994), who derive similar results for credit markets characterized by asymmetric information.

In practice, as we have found, the derived conditions for optimal lending structures are not consistently applied. Although the American SBA does act as gap lender, it simultaneously limits the interest rate that can be maximally charged by private banks, if loans are complemented by federal guarantees. In addition, the SBA's statutes require the agency to act as self-financer, i.e., to finance the 7(a) loan guarantee program with the fees of participants. These two restrictions could prevent the SBA from achieving market failure correction. Interest-rate caps can also be observed with the policy of the German KfW. Moreover, the KfW promotes investors regardless of whether or not they can obtain financing elsewhere, thus indicating structural inefficiencies here as well. Unless the current practices of the SBA and KfW can be justified with arguments beyond the scope of our model, we see room for greater efficiency and, thus, further reform with both institutions.

Our analysis is intended to support the decision making process of federal institutions in optimizing their lending structures. We therefore modeled public credit programs along their two most basic dimensions, i.e. risk and interest rates. In practice, however, financial institutions decide on additional parameters as well, such as loan size or repayment terms. Specifically, it is quite common to refuse the subsidization of loans whose volumes exceed a specific limit. In contrast to commercial banks, public institutions also ease the terms of repayment by extending maturities and permitting repayment-free periods. These benefits are primarily intended to meet the needs of start-ups which typically face negative cash flows in the first months of operation. An inclusion of these elements into the analysis would allow for a more detailed characterization of optimal federal lending structures.

Another issue that demands further research concerns the social rate of return. As we have argued, this rate needs to be assessed in order to identify market failure. Specifically, the lending institution is required to find out if the financing costs of a loan-gap project fall below the sum of the investor's return and the total benefits to others outside the innovation's market. Although, there might be projects with an obvious social-return overhead, e.g. radical technology innovations, there exist marginal cases for which a precise assessment proves difficult or prohibitively costly. In general, federal institutions could cope with the limited knowledge of social returns by defining criteria that help identify eligible projects, e.g. branch or type of innovation. An extension of our framework to such eligibility criteria would increase the practicability of our derived policy implications.

Finally, our analysis has been limited to federal lending so far. However, governments often run parallel equity programs aimed at promoting high-risk ventures. For example, the SBA invests via privately owned Small Business Investment Companies (SBIC) and the KfW co-finances start-ups, SMEs, and technological firms through the ERP Start Fund. Studying both generic alternatives of finance simultaneously would tackle the issue of an optimally combined application in market failure correction.

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