Order Number 9426322

The nonprofit firm in a market setting

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The University of Arizona, 1994

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THE NONPROFIT FIRM IN A MARKET SETTING

by

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A Dissertation Submitted to the Faculty of the

DEPARTMENT OF ECONOMICS

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Robert Julius Franciosi

entitled The Nonprofit Firm in a Market Setting

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

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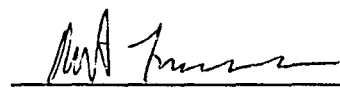
SIGNED: 

ACKNOWLEGDEMENTS

This sort of thing is always unfair since it is impossible to recognize everyone who has helped me in the past five years. However, I want to thank the members of my committee by name: R. Mark Isaac, Stanley Reynolds, and Michael Block.

The experiments were funded by NSF grant SES 8821067 to Professor Isaac.

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ABSTRACT

This dissertation analyzes the nonprofit sector using a framework developed by economists to analyze for-profit industries. Its central hypotheses are that nonprofit 'firms' are run by self-interested individuals and compete for donations in a 'market'. It develops a model that demonstrates that nonprofit contracts are not necessary to solve the principal-agent problem that stems from a good being financed by unconditional lump-sum donations. The effects of nonprofit contracts in the model are ambiguous and might very well be harmful.

The model is tested using both field data from California and laboratory experiments. The tests broadly support the model.

INTRODUCTION

In between private, for-profit firms and the government is a third sector of private organizations, run ostensibly not to make a profit: the nonprofit sector, also called the third or voluntary sector. Observers since de Tocqueville have noted that Americans have a vigorous voluntary spirit, and today the nonprofit sector plays a large role in several important sectors such as health and education.

Economists since before de Tocqueville have advocated a competitive, decentralized system as the best way for a society to create and allocate goods and services. The nonprofit sector offers the tantalizing possibility of the decentralized, competitive provision of public goods; goods thought by some that the private, for-profit sector is unable to provide.

This dissertation analyzes the nonprofit sector using a framework developed by economists to analyze for-profit industries. Its central hypotheses are that nonprofit 'firms' are run by self-interested individuals and compete for donations in a 'market'. This work is important because the issue of competition among nonprofit organizations has

been raised before, the case brought by the Justice Department against the Ivy League schools, for example; and promises to become even more important in the future. In the current debate over a national health plan, the question of whether there should be one or several purchasing cooperatives per region hinges on the issue of competition.

Chapter One discusses the nature and the size of the nonprofit sector, and surveys theories about why it exists. Chapter Two develops a model that is based on one of the reasons why nonprofits might exist: the contract failure theory. In particular, the necessity of unconditional, lump-sum donations to finance certain goods, and the principal-agent problem it creates. The chapter shows that nonprofit contracts or no, goods financed by donations can be provided by organizations run by self-interested individuals. Nonprofit contracts do offer an improvement, but this depends on the structure of the market.

Chapter Three tests the model using data for nonprofit organizations in California. It finds that a traditional measure of competition, the number of firms in the market, does have a significant effect on the fraction of revenue

firms spend on services.

The fourth chapter is an experimental test of the model using human subjects. This allows an empirical test of a change in institutions that a researcher would be fortunate to observe in real life: what the world would be like with and without nonprofit organizations. The results broadly support the model, however the specific strategies the model predicts are not followed by the subjects.

The four chapters are followed by a conclusion and suggestions for future research.

Chapter 1

THE NONPROFIT SECTOR

Nonprofit is a broad term that includes organizations from the Department of Defense to a local day care center. Even the private nonprofit sector embraces a diverse group of organizations including clubs, professional associations, hospitals, lobbying groups and universities. Strictly speaking, a nonprofit corporation is an organization that is not allowed to distribute profits or pay dividends by the corporate law in the state where it incorporates. Payments to managers and other factors of production are limited to a 'reasonable' amount. Nothing prevents a nonprofit corporation from earning a residual, it is just prevented from giving it to founders or management, and so presumably it must use it to finance additional output. This restriction is usually called the nondistribution constraint.

One loophole in the nondistribution constraint is that states place few limitations on the distribution of assets after the corporation is dissolved. In Arizona, when a charitable, religious, benevolent or similar type of organization breaks up, it must give its assets to an

organization with a similar purpose. Other types of nonprofit corporations are free to distribute their assets to members upon dissolution after creditors and others are taken care of.(Arizona Revised Statutes 10-1026)

Nonprofit organizations are also defined by Federal regulations. An organization is exempt from Federal corporate income tax, except for unrelated business income, if it adheres to a nondistribution constraint and falls into one the categories listed in Table One. State statutes have limited the purpose for which a nonprofit corporation can be formed but the trend has been toward less restrictions on the functions a nonprofit corporation may do.(Hansmann 1981c p 510) In Arizona, a nonprofit corporation may be formed for "any legal purpose".(Arizona Revised Statutes 10-1004) However, restrictions are put on the types of organizations that may be tax exempt.

Federal and state definitions of nonprofit organizations are not identical so the nonprofit but not tax exempt television repair corporation is a theoretical possibility; so is the exempt but unincorporated charity or club. There are also the myriad support groups, clubs, and associations

that aren't corporations and don't pay taxes yet are included by researchers in the 'third' or 'voluntary' sector.

Nonprofit organizations receive other forms of special treatment from government. Charitable nonprofits, those exempt under section 501(c)(3), are prohibited from electoral campaigning, limited in the amount they may spend on legislative lobbying, and subject to special rules on public interest litigation. On the other hand they are allowed to mail at a special rate. Contributions to such organizations by individuals and corporations are deductible from income taxes up to a certain limit.(Simon 1987)

Contributions to other organizations exempt under 501(c) are not tax deductible. Nonprofit organizations that aren't charitable are not prohibited from or restricted on political activities, and most do not get the special postal rate.

In addition, nonprofit organizations are subject to special treatment under Federal securities regulations, the Federal Unemployment Tax Act, the Robinson-Patman Act, and several other state and Federal regulations.(Simon 1987)

Hansmann(1986) developed a useful taxonomy of nonprofit organizations that classifies them along two dimensions:

governance and source of income. He calls nonprofit organizations that receive their income from donations donative. Those that are funded by the sale of goods and services he terms commercial. The American Cancer Society is a donative nonprofit; a hospital is a commercial nonprofit. If the patrons of an organization, those people who are its ultimate source of funds, also are the organization's ultimate controllers, then Hansmann calls the organization a mutual nonprofit. An organization not controlled by its patrons is an entrepreneurial nonprofit. A country club is a mutual nonprofit; a university is an entrepreneurial one. The above terms describe polar cases. Of course, groups may fall between the extremes. Environmental groups receive donations and sell t-shirts, jewelry, and coffee mugs. Alumni may be represented on a university's board of directors.

Weisbrod(1980) classifies nonprofit organizations by the collective nature of their output. He defines collective goods as those with a high degree of external benefit; benefit that the provider cannot capture. Since firms capture a benefit by packaging and selling it, it is logical

to conclude that firms that provide goods with a high collective nature must rely on a type of financing other than sales. So a proxy measure for the collective nature of an organization's output may be the fraction of income it receives through donations. Note that this is an imperfect proxy since, as mentioned above, organizations like charities and public television stations can subsidize output with proceeds from the sale of other items.

Salamon(1987) also classifies nonprofit groups by the source of funds: fee based, analogous to Hansmann's commercial nonprofits; donation based; and government based. This system is mixed since fees and donations are a type of income while the government is a source. Government financing may take the form of a grant or as a fee for services provided.

Size of the Nonprofit Sector

Table One shows the number of exempt organizations listed on the Internal Revenue Service's exempt organizations and business master file in 1990. The total shown is surely an underestimate of the number of organizations in the

nonprofit sector since churches and organizations with less than $5000 annual income do not have to apply to the IRS for recognition of exemption.[1] In 1982 the IRS listed 841,440 exempt organizations so there has been over 20 percent growth in the number of nonprofit organizations in the Eighties.

Table Two shows the size of the nonprofit sector nationally. It accounts for 6 percent of national income and establishments and close to 10 percent of employment. Although relatively small in terms of total output the nonprofit sector plays a large role in several important industries. Table Three shows the nonprofit sector's share of selected industries.

Tables Four and Five show the size of the nonprofit sector in the Tucson area. Measured by the number of establishments the nonprofit sector accounts for over 25 percent of health services and close to 50 percent of social services in Tucson. Although the number of nonprofit establishments is small relative to the entire service sector, nonprofit organizations account for 25 percent of employment in Tucson's service sector. A majority of these

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[1]Annual Charity Index, Better Business Bureau, p15.

Table 1.--Number of Organizations Listed on Exempt Organizations and Business Master File

Section 501(c)	
(1) Corporations organized under act of Congress	9
(2) Titleholding corps	6,278
(3) Religious, charitable, etc.	489,882
(4) Social Welfare	142,273
(5) Labor, agricultural organizations	71,653
(6) Business leagues	65,896
(7) Social and recreation clubs	62,723
(8) Fraternal beneficiary societies	100,321
(9) Voluntary employees' beneficiary societies	14,210
(10) Domestic fraternal beneficiary societies	18,350
(11) Teachers' retirement funds	10
(12) Benevolent insurance assns.	5,873
(13) Cemetery companies	8,565
(14) Credit unions	6,352
(15) Mutual insurance companies	1,137
(16) Corps. to finance crop operation	19
(17) Supplemental unemployment benefit trusts	667
(18) Employee funded pension trusts	8
(19) War veterans' organizations	27,460
(20) Legal service organizations	197
(21) Black lung trusts	22
(22) Multi-employee pension plans	0
(23) Veterans associations founded prior to 1880	2
(24) Trusts described in section 4049 of ERISA	0
(25) Holding companies for pensions etc.	107
501(d) Religious and apostolic organizations	94
501(e) Cooperative hospitals	76
501(f) Cooperative service organizations of operating educational organizations	1
501(k) Treatment of certain organizations providing child care	9
521 Farmers' cooperatives	2,372
Total	1,024,766

Source: Annual Report of the Commissioner of Internal Revenue 1990.

Table 2.--The Size of the Nonprofit Sector 1980

Sector	National Income		Employment		Number of establishments	
	Dollars (billions)	percent	Number (1000s)	percent	1000s	percent
Nonprofit	134.3	6.0	11,077	9.9	1,182	6.6
For profit	1794.6	80.1	80,296	72.1	16,793	93.0
Government	312.6	14	20,052	18	83[1]	0.5
Total	2,241.5	100	111,425	100	18,058	100

Note: 1. Local government organizations only.

Source: Hodgkinson and Weitzman(1984): income Table 1.1 p. 11; employment Table 1.5 p. 13; number of establishments Table 1.7 p. 15.

Table 3.--Share of Nonprofit Sector in Selected Industries

Industry	Measure	Nonprofit	For profit	Government
Short term and general hospitals	Facilities	53%	12%	35%
Nursing homes	Facilities	34	61	5
Education				
Elementary and secondary	Enrollment	10	1	89
Higher	Enrollment	24	NA	76
Day care centers	Facilities	43	57	NA

NA-not available.
Source: Steinberg 1987: Table 7.1.

Table 4.--Size of the Nonprofit Sector Tucson MSA:
Number of Establishments

Sector(SIC code)	Number 1982	Number 1987	Number for profit 1987
Camps and membership lodging(7032, 7041)	14	13	14
Selected amusement, recreation and related services(792, 7991pt, 7997, 7999pt, 84)	30	43	14
Selected health services	19**	40	112
Clinics of doctors and dentists(8011pt, 8021pt)	na	6	41
Nursing and personal care(805)	na	4	25
Hospitals(806)	na	11	8
Other(808,9)	na	19	38
Legal aid services(81)	3	3	na
Selected educational services(823,4,9)	11	9	36
Social Services	150	154	157
Child day care(835)	36	24	91
Individual and family(832)	na	57	na
Job training and vocational rehabilitation(833)	na	13	na
Residential care(836)	na	24	na
Social Services(839)	na	36	na

Table 4.--Size of the Nonprofit Sector Tucson MSA
(continued)

Sector(SIC code)	Number 1982	Number 1987	Number for profit 1987
Selected membership organizations(861,2,4,9)	136	151	na
Research, testing, and consulting except facilities support management services(873,4)	6	13	281

**: Hospitals not included.
na: not available
Includes only establishments with payroll.
Source: Census of Service Industries, Geographic Area Series, Arizona, U.S. Department of Commerce, Bureau of Census.

Table 5-Size of the Nonprofit Sector Tucson MSA:
Revenue and Employment 1987

Sector(number of organizations)	Receipts ($1000s)	Annual Payroll ($1000s)	Paid employees
Camps and membership lodging(13)	2,428	313	60
Selected amusement, recreation, and related services(43)	39,546	12,439	1085
Clinics of doctors and dentists(6)	8,209	4,043	204
Nursing and personal care(4)	9,278	5,065	404
Hospitals(11)	446,869	209,552	9,810
Other health services(19)	14,201	6,616	448
Legal aid(3)	1,387	917	50
Selected educational services(9)	2,793	2,088	107
Child day care(24)	3,361	1,844	248
Individual and family(57)	16,099	7,931	720
Job training and vocational rehabilitation(13)	14,859	8,171	984
Residential care(24)	13,023	5,963	522
Social services(36)	46,030	4,248	349

Table 5.--Size of the Nonprofit Sector Tucson MSA:
(continued)

Sector	Receipts ($1000s)	Annual Payroll ($1000s)	Paid employees
Selected membership organizations (151)	31,588	11,069	1,198
Research testing and consulting (13)	27,799	10,977	442
Total tax exempt (426)	677,470	291,236	16,631
Total all Tucson for profit service industries (4703)	1,915,150	740,901	48,712

Source: see Table 4.

workers are employed by hospitals.

Growth in Tucson's nonprofit sector during the Eighties was mixed. There was a large increase in the number of membership organizations and amusement and recreation services. There was only a slight increase in social services and a decrease in the number of child care service providers. Since hospitals aren't included in the number of health services for 1982 it is impossible to tell for certain the change in that sector. If the number of hospitals remained the same over that period, then the health sector grew as well.

Why Nonprofit Firms?

Why does society choose to organize certain activities in the form of nonprofit rather than for-profit organizations? Hansmann(1986) points out that this question may be backwards. Harvard College, the oldest corporation in the original thirteen colonies, was a direct descendant of Oxford University chartered in the Twelfth Century. Charters for monasteries and other religious corporations were used even earlier. The for-profit corporation did not

appear until several hundred years later.[2]

The Residual Demand Theory

Economists have developed several theories explaining why nonprofit firms exist. Weisbrod(1986) develops a model where nonprofit institutions spring from residual demand for public goods. Government provision of public goods is set at a level to satisfy the median voter. Consequently there is a residual demand that is satisfied through private organizations. Weisbrod's model has the following implications.

The output hypothesis. Since nonprofit organizations satisfy unmet demand for public goods provided by the government we can expect nonprofit institutions to produce output that closely resembles government goods. In sectors where government, private nonprofit organizations, and profit maximizing firms coexist, government and nonprofit organizations will supply forms of the good with a strong collective consumption component while the profit maximizing firms will supply private consumption forms of the good. For example, nonprofit and government hospitals can be expected

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[2]Hall(1987), Hansmann (1986) note 2.

to provide more care to the indigent. Government and nonprofit schools concentrate more on general education and research while for profit schools provide vocational education.

The income hypothesis. Demand for public goods is positively related to income over a range of incomes. At high incomes, however, consumers prefer private substitutes to public goods since these provide greater control and can be tailored to individual tastes. Therefore, we can expect the relative size of the nonprofit sector in a region to increase and then decrease as income increases.

The demand variance hypothesis. The more diverse a region's population, the more likely there is to be unsatisfied demand for public goods. So the nonprofit sector should be larger, other things equal, in areas with heterogenous populations.

The above hypotheses were tested for hospitals(Lee and Weisbrod 1977) and education(Bendick 1977). The results of both studies support the theory.

Weisbrod's model explains why the nonprofit sector exists but it doesn't explain why it is nonprofit. This gap has been filled by James(1986b). She observes that most of

the entrepreneurial effort that satisfies the residual demand for public goods comes from religious groups, unions, political parties, and similar groups. These organizations wish to maximize membership rather than profits, hence the nonprofit organization. These organizations have several competitive advantages over their profit maximizing counterpart. They have a semi-captive audience; a low cost source of labor in volunteers, nuns, and ministers; and a reputation of trust among their customers. They also have enough political clout to get special treatment from the government.

James tested her modification of Weisbrod's theory on secondary education in Japan. Japan isn't anyone's example of a heterogenous society but the peculiarities of public finance there cause a residual demand for secondary education. James found that the greater the residual demand, the greater the number of nonprofit secondary schools. She also found that proxies for entrepreneurial effort, the relative size of Christian clergy, the number of prewar Christian schools, also had a positive effect on the number of nonprofit schools.

The Screening Theory

Young(1986) develops a model where entrepreneurs are screened by the organization of firms and industries. By being nonprofit, a firm attracts those who are more interested in promoting the cause of an institution, preserving its traditions, or fostering professional excellence than in maximizing income.

The Contract Failure Theory

This dissertation is based on the contract failure theory of nonprofit firms developed by Hansmann(1986) and others. It states that the nondistribution constraint exists to provide a disincentive for opportunistic behavior by a firm's managers. Nonprofit firms, then, exist in situations where consumers are particularly vulnerable to opportunistic action. These situations arise because consumers can only imperfectly monitor output.

There are several reasons why this might be the case. The service provided may be technically complex and the outcome may hinge on factors that neither the consumer or the provider can control. The consumer then cannot tell if an unfavorable outcome was due to bad luck or poor performance

by the provider. Medical care is an example of such a good.

Second, the good may be delivered to parties who are separate from the purchaser. Education, day care, and nursing home care are often purchased by relatives of the direct consumer of the service. In many cases the recipient is not competent to judge the quality of service. Also, provision is over extended periods of time, often years, so the cost of switching providers may be high. In these cases the buyer can only monitor indirectly and is a semi-captive customer and so is open to opportunistic behavior by the seller.

Since the nondistribution constraint of a nonprofit organization makes it difficult for a manager to benefit from exploiting consumer vulnerability, the consumer may trust nonprofit producers more than for profit ones.

In the above cases much of the service is provided on a pay-per-unit basis. Many nonprofit organizations, however, receive unconditional, lump-sum grants from donors. The potential for opportunistic behavior in this situation is obvious. The question is why some goods and services are financed in this way. The answer again is that output is

very costly to monitor by consumers, so conventional pay-per-unit contracts are impossible to write.

One reason for this may be that the buyer and the recipient are two different people. In the case of international relief, the two may be half a world apart. Another reason is that the good may be a public good with an overall budget large relative to individual donations. This may make it difficult for the consumer to monitor the marginal effect of his donation.

Even with perfect monitoring, large public goods have characteristics of financing that may make pay-per-unit contracts difficult to write. An example may clarify these points. Consider the pseudo-prices listed on a fundraising letter sent out by a local public television station.[3]

Show	Number of $30 donations to finance one hour
Great Performances	38
Sesame Street	7
NOVA	21
Frugal Gourmet	3

[3]Fundraising letter mailed by KUAT television station, University of Arizona, Tucson. In author's possession.

Solicitations are often written like contracts and contain such pseudo-prices: "your donation of X dollars will feed Y children this Christmas."

The station's output can be monitored by anyone with a television set in range of its transmitter. Suppose it wished to finance its broadcasts through individual contracts with its viewers. A generous giver could finance a whole hour or even an entire series. What if a donor wishes to contribute $30 toward one hour of Great Performances. The contract he writes with the station would have to specify what would happen to his donation if thirty-seven others fail to contribute toward the show. Is it refunded or applied to another show, and which show? Suppose no-one supports the Frugal Gourmet, then the overhead imputed in its price would have to be spread over the rest of the shows; raising their price. Contracts would have to account for this contingency as well.

Economists have developed contingent auctions for these types of situations. Such smart markets have been developed for natural gas (McCabe, Rassenti, and Smith, 1990) and airport landing slots (Rassenti, Smith, and Bulfin, 1982) The

public broadcasting stations themselves use one to decide which shows to finance (Ferejohn, Forsythe and Noll, 1979). Technology may make it feasible one day for a station to implement such an auction with its viewers, but until then it is excusable for a station's management not to incur the cost of writing the complex contracts necessary for $30 donations.

Monitoring is more difficult for small donations. Even a relatively small organization can swallow a twenty-five dollar donation without a trace. Large sums are easier to track so a substantial donor may be able to contract on a pay-per-unit basis with the organization. Governments and foundations require grant proposals to contain detailed information about who is to be hired, what facilities are to be built, and what equipment is to be purchased. Follow-up reports of services provided are also required.

The small donor is not without recourse. He can monitor output of an organization by volunteering to work for it. There are also private monitoring agencies. The Better Business Bureau publishes an Annual Charity Index and a bimonthly newsletter that provides information on charitable

organizations. What it monitors, however, are inputs and firm behavior: does it spend a 'reasonable' percentage of total income on administration? does it meet Better Business Bureau standards on public accountability, governance, and solicitation? What it doesn't monitor is how effective the organization is in fulfilling its ostensible purpose: the number of hungry fed, sick cared for, homeless sheltered.

Given these private monitoring mechanisms, what is the advantage of government monitoring? Here I mean government monitoring through laws concerning nonprofit organizations rather than government monitoring as a donor. Volunteer work may be unavailable or too costly to the donor. However, government monitoring is little different from private monitoring like that done by the Better Business Bureau. Both monitor behavior and the use of inputs. The advantage of government monitoring to the individual donor is clear. To use the Better Business Bureau a donor must pay thirteen dollars for its Annual Charity Index and two dollars per issue for its bimonthly newsletter. In addition to these out-of-pocket costs there is the time spent perusing the material. A government agency, on the other hand, could do

the same thing and spread its costs over all the state's taxpayers. The time costs are nil and the out-of-pocket costs are probably less. The donor does have to determine if the organization is a legitimate charity monitored by the government. Whether the government alternative is more efficient due to economies of scale is an empirical question.

The Internal Revenue Service is a different matter. It is the instrument chosen by society to deliver a subsidy to certain organizations. Its activities are analogous to a large and powerful donor, determining eligibility for the subsidy. Since it requires firms to report financial information in form 990 anyway, its practice of making firms provide copies to the public probably imposes little additional cost.

As Hansmann points out the assurance provided by the nonprofit form of organization is not without cost. Taking away a manager's incentive to engage in opportunistic behavior also takes away her incentive to engage in efficiency enhancing behavior. Empirical studies have found evidence that nonprofit corporations may be more inefficient. See Feigenbaum(1980) and Steinberg(1987) for a review. Also

the restrictions on issuing shares makes raising capital more difficult.

The contract failure theory has been criticized on several grounds by James(1986a, 1986b), West(1989), and others. The most obvious objection is that many complex technical services are provided on a for profit basis by lawyers, surveyors, and auto mechanics. Second, nonprofit organizations also engage in cross subsidization, so there is no way for the customer to know if the nonprofit constraint is keeping the firm from exploiting him or if it is exploiting him to pay for some activity or service that the firm's management prefers more. Also, as James observes, the size of the nonprofit sector varies across countries yet there is no reason to believe informational asymmetry does. West contends that nonprofit organizations exist primarily because of the special treatment they receive at the hands of the government. They are able to get these favors by playing on popular prejudice against the profit motive.

The contract failure theory has received formal mathematical treatment at the hands of Easley and O'Hara(1983) and Chillemi and Gui(1991). The solution to the

typical principal-agent problem is to make the agent's fee dependent on the outcome, giving her the incentive not to shirk. In Hansmann's model the problem is not shirking but the agent being too aggressive in increasing profits. Formally, the nonprofit organization is modelled as paying the manager a fixed fee, or reducing the amount of the residual she is able to capture.

Easley and O'Hara show that if output is unobservable, inputs other than the agent's effort are observable, and technology is such that the minimum effort by the agent results in positive output, then nonprofit firms will produce positive output whereas a for-profit firm would produce none. This is because a for-profit firm appropriates all the output while in a nonprofit firm, because management's share is fixed, a residual goes to the consumer.

Chillemi and Gui model a situation where output has a variable quality that is observable to the consumer after purchase. Klein and Leffler(1981) have shown that in this situation the promise of repeat business is enough to induce a firm to produce high quality goods. Chillemi and Gui show that if an upper bound is placed on the amount of the

residual the firm's manager may capture, consumers are made better off. These points are also made in the model in the next chapter and will be explained more fully there. The next chapter will also explore the effect of market structure on these conclusions.

Permut(1981) tested Hansmann's model by conducting telephone interviews with 225 households. He tried to determine if the respondents felt nonprofit organizations were more trustworthy, if they would take nonprofit status into account when choosing a provider, and if they could even identify an organization as nonprofit.

He found that a majority did not recognize five organizations on a list of organizations as nonprofit. Thirty-five percent of respondents perceived no difference between profit and nonprofit organizations; and over 50 percent did not feel they would be treated more fairly by nonprofit organizations. A majority did not care if a nursing home, summer camp, hospital, or insurance company was nonprofit.

Permut's study dealt only with what Hansmann called commercial nonprofits. Most of the public interacts with

these organizations as customers so the monitoring problem is less acute than with donative nonprofit organizations. Whether donors care what type of firm they give to is left unexamined. Many of those interviewed were unlikely to have been patrons of some of the organizations on Permut's list. Patrons would be more likely to know and care if the organization was nonprofit. Finally, a large number of respondents who felt nonprofit status was important would select a nonprofit organization.(Hansmann 1981a)

Another test of the trustworthiness of nonprofit firms was carried out by Weisbrod and Schlesinger(1986) on nursing homes. They looked at two types of faulty service: code violations and complaints. Their hypothesis was that code violations measure easily monitored characteristics and complaints are a proxy for intangible and hard to monitor aspects of service. Nonprofit theory predicts that nonprofit nursing homes should have less complaints than other types. Weisbrod and Schlesinger found that private nonprofit nursing homes had significantly more violations than private, for-profit homes. Homes operated by the government and nonprofit organizations affiliated with religious groups showed no

significant difference with for-profit homes in the number of violations. All nonprofit homes, private, religious, and government, had significantly fewer complaints than for-profit homes. This supports the theory that the nondistribution constraint moderates exploitation by firms of situations with asymmetric information.

Conclusion

Both the residual demand theory and the contract failure theory are plausible and have some empirical support. The residual demand theory explains the boundaries between the government, private nonprofit, and for-profit sectors. James'(1986a) addition explains why private provision of collective goods is provided by nonprofit organizations. The contract failure theory is not contrary to this. Surely one of the reasons a firm is nonprofit is to assure donors that their donations go toward the intended purpose.

The contract failure theory is less convincing when applied to commercial nonprofits providing private consumption goods. Although, as Weisbrod and Schlesinger show there is some support for the conjecture that commercial

nonprofits are more trustworthy. Given the wide variety of nonprofit organizations it is not surprising that a grand, unified theory of nonprofit organizations has been difficult to develop.

Chapter 2

THE NONPROFTIT FIRM IN A MARKET SETTING

This chapter develops a model of a market that is financed by unconditional lump-sum payments by consumers of the good; a method of financing that presents an obvious principal-agent problem. As discussed before, the nonprofit firm is considered a potential solution to this type of problem. The model presented here has three major implications.

Nonprofit contracts are not necessary to solve the principal-agent problem inherent in financing by unconditional donations. When a donor and a firm interact repeatedly then a donor can keep a firm's management from misbehaving by the implicit or explicit threat to withhold future donations if management acts in a way the donor finds unsatisfactory. No formal limits on managerial compensation, such as a nonprofit contracts, are needed.

For this type of solution to work the agent must be paid an amount above her opportunity cost as a carrot to bribe her from wrongdoing. Repeated interaction among a group of actors, the payment of a premium to assure proper

performance, and the boycotting of defectors are components of a common solution concept widely used by economists to model situations where trust is needed. The germ of this concept dates all the way back to Adam Smith. The list of applications includes product quality (Klein and Leffler 1981), the labor market (Shapiro and Stiglitz 1984), and medieval trade (Greif 1989; Milgrom, North, and Weingast 1989).

Recent events have furnished an example in the nonprofit world itself. A spending scandal involving the president of the United Way of America led to a fall in public confidence in federated campaigns and charities in general. Less trusting consumers were expected to give less, which is part of the reason why fundraisers expected a disappointing 1992 campaign (Sebastian 1992).

Nonprofit contracts may make consumers better off. Given that theory predicts, and there is empirical support for, the engendering of trust through private means what is the advantage of a formal, centralized constraint? Some of the advantages of government monitoring have been discussed before. The power of government that is pertinent to the

model presented here is the ability to punish with substantial negative penalties rather than merely withholding future business. This lowers the benefits to managers of malfeasance which means the stream of rents that must be paid to them can also be lowered. This money can go directly to provide more of the good.

The above two points were also made by Chillemi and Gui(1991). They made the stronger assertion that nonprofit contracts are a Pareto improvement. In the model presented here the effect of nonprofit contracts ranges from beneficial to neutral to harmful.

The final point of this chapter is that numbers matter in the same way that numbers matter in the market for sugar or steel. Fewer firms leads to less provision of the good and higher income for the firms' proprietors. This point may not be startling to economists but it is quite different from the way Federal judges, newspaper editors, and workers in the nonprofit area think of this sector. The editorial "Charity Covers a Multitude of Dins" in the March 30, 1978 Los Angeles Times calls for a merger between two rival fund raising organizations. The Tucson Community Council calls for

greater cooperation among charities in its report Fund Raising in Tucson(1960). Banisk(1980) reports that an antitrust suit against the United Way failed because the judge thought that "the term 'monopoly' doesn't even apply to charitable fund raising organizations."

An alternate model of nonprofit competition developed by Feigenbaum(1980) reaches the same conclusion by a different path. In Feigenbaum's model firms produce a good whose quality consumers cannot determine perfectly. Consequently price competition of the type described in this chapter is impossible since consumers associate lower prices with lower quality. Instead firms compete by providing consumers with auxiliary goods and services like tote-bags, coffee mugs, or bumper stickers that provide utility directly to donors. Competition makes donors better off but not through increased provision of the good they are purportedly financing.

In the model presented here consumers cannot monitor output but they can observe the fraction of donations an organization's manager spends on herself costlessly and perfectly, so a form of price competition is possible. The

principal-agent dilemma comes from the sequential nature of the donation institution. A donor gives an unconditional grant, then the manager decides what to do with it. Since there is no formal agreement, the manager may provide as little of the good she wishes, pocketing the rest of the donation.

One qualification of this model is that in game theory the folk theorem of repeated games tells us that when agents interact repeatedly trigger strategies can support numerous outcomes. There are then many possible outcomes in the model that contradict the effects of competition predicted above. For example, firms may maintain a successful cartel, or consumers may keep a single firm at the competitive level of output through trigger strategies. However, I emphasize the more exact predictions of the competitive model because they can be proven wrong in the tests described in later chapters.

One final qualification of the model is that it is based on firms' managers being motivated solely by direct monetary compensation. The effects of competition may differ if managers pursue other goals because of personal preference or the desires of trustees. In this case competition may

produce perverse effects. In another paper, I show that collusion among universities may actually lead to more students attending school (Franciosi 1992).

The Model

I will start with a single consumer who donates a lump sum m to an organization to provide a good y. After receiving the donation the entrepreneur sets aside a fraction r for her personal consumption and uses the rest to produce y. Assume the entrepreneur's cost function for y has a constant marginal cost and no fixed costs. At the end of each period the consumer observes r at no cost. Since r is a marginal cost to the donor of producing y, the donor would like r as low as possible. Assume that the donor gives according to the function m(r), with m increasing as r decreases.

The variable r represents explicit payments, such as salary, and implicit payments through self-dealing to the entrepreneur. Self-dealing consists of the purchase of factors in which the entrepreneur has a financial interest and the purchase of factors in inefficient amounts, including

those that have zero marginal product, due to the entrepreneur's personal preferences. Given these components it is reasonable to model the benefits to manager as an increase in marginal cost as is done here.

If the consumer and entrepreneur interact only once, then there is no incentive for the entrepreneur to provide any of the good. She keeps the entire amount of the donation and produces no y. The consumer, knowing this, donates nothing. Thus m=0 and r=1 is the equilibrium in the one-shot game.

If the two interact infinitely often then the consumer can play a strategy which gives an incentive for the entrepreneur to provide a positive amount of the public good. Suppose the consumer donates the first period and continues to donate each period if a positive amount of y was produced in the previous period. If the entrepreneur retains the entire donation for one period then the consumer will not ever donate again. This grim trigger strategy can support an equilibrium where the good y is produced.

If the entrepreneur decides to abscond with the entire donation in a single period her utility is m. By doing this

she forfeits the payment of rm forever. To give her the incentive not to defect the utility she receives from the stream of payments must be greater than her utility from defecting, or

$$m \leq \frac{1}{1-\delta} rm, \tag{1}$$

or

$$r \geq 1-\delta. \tag{2}$$

where δ is the discount rate. This is the entrepreneur's no defection constraint. Note that it implies that r must be positive if m is positive. The entrepreneur chooses r to maximize her utility function

$$V = rm(r). \tag{3}$$

Call the value that does so r*. r* may be greater than $1-\delta$ but there is no guarantee of this. If r* is less than $1-\delta$ then the entrepreneur would settle for setting r at $1-\delta$. The monopolist's choice of r then is max[r*, $1-\delta$].

Suppose now there are multiple firms in the market each with objective function (3) and identical production functions. Since the good is produced at constant returns to scale the consumer can choose the firm with the lowest r.

Firms will lower their amount deducted to attract additional donations. This competition will force r to decrease until it is equal to $1-\delta$. A donor will not give to a firm with an r below $1-\delta$ since he knows there is no incentive for the firm to provide the good. Note that the competitive equilibrium may be very close or even equal to the monopoly value if r* is less than the no defection constraint. The distribution of donations among firms and the number of firms in the market is indeterminate.

In the model r is observed by assumption. In reality, observing r is more problematic but not impossible. Weisbrod and Dominguez(1986) have found that the effective price of a nonprofit organization's output, a function of the tax rate and the fraction it spends on services, has a significant effect on the amount of donations it receives. Firms can signal r through gala fundraisers, advertising, and liberal distribution of goodies to donors. These expenditures can be thought of as investments in brand name capital. These investments are sunk since they become worthless if the firm loses its good name because of malfeasance.

Nonprofit Firms

I now turn to a situation where nonprofit contracts are available. I model the nonprofit contract as follows: a firm voluntarily declares itself a nonprofit and thereby become subject to a trigger strategy by the government that has the following form:

$$m_g = -\infty, \quad \text{if } r > \hat{r},$$
$$m_g = m_g(r), \quad \text{if } r \leq \hat{r}.$$

That is if a manager withholds above some threshold $\hat{r}$ the government inflicts a severe penalty. For managerial compensation below the threshold the government distributes grants to the firms in a conventional way.

In a world of perfect observation and costless enforcement the contracts would be truly nonprofit, that is the government could set $\hat{r}=0$. Since the world is not perfect or costless it is reasonable to assume that $\hat{r}>0$. So there is some profiteering by firms' management.

If a firm receives a total donation of m its maximum possible gain from withholding is $\hat{r}m$. A firm will adhere to an equilibrium value of r if $\hat{r}m \leq rm/(1-\delta)$ or $r \geq (1-\delta)\hat{r}$. Note that I am assuming that the donors react to any increase in r from the equilibrium value with a perpetual boycott of

the deviant firm. The nonprofit contract lowers the no defection constraint.

The effects of nonprofit contracts depend upon market structure and how vigorously the government monitors the nonprofit constraint; that is, how low the government sets $\hat{r}$. I address the possibilities case by case.

Case 1: monopoly. Let r_m be the value of r set by the monopolist if nonprofit contracts are not available.

1.1) $\hat{r} > r_m \geq (1-\delta)$ and $r_m = r^*$. Neither the nonprofit constraint nor the no defection constraint is binding. The monopolist chooses r to maximize her utility. Nonprofit contracts have no effect on profits or the level of output.

1.2) $r_m = r^* > \hat{r}$. Nonprofit contracts force the monopolist to lower the amount she is deducting. Her profits fall and the level of output increases. In this case the firm would not voluntarily organize itself as a nonprofit unless there was some other advantage from nonprofit status, such as tax exemption, that offsets the loss in monopoly profits.

1.3) $r_m = (1-\delta) > r^*$. The nonprofit constraint is not binding but the no defection constraint is. This prevents the monopolist from setting r at her profit maximizing level.

Nonprofit contracts allow the monopolist to credibly lower the amount she deducts. This enables her to move toward her profit maximizing level. Output increases. Nonprofit contracts make both parties better off.

Case 2: competitive market. Nonprofit contracts allow firms to credibly set r at a lower level. If other firms are for-profit, it is to a firm's advantage to become a nonprofit, lower the amount it deducts, and attract all the donations. Competition among nonprofit firms will drive r to $\hat{r}(1-\delta)$. In a competitive market then all firms will be nonprofit and the amount they deduct will be equal to $\hat{r}(1-\delta)$. Consumers are made better off since output increases. Firms are worse off since they make less profits unless $(1-\delta)$ is greater than r^* in which case firms are made better off as well.

Finally, since the folk theorems allow the possibility for any outcome without nonprofit contracts, they prevent a precise prediction of the welfare effects of changing to the regime of nonprofit contracts. Shifting the no defection constraint down does allow for more outcomes favorable to the consumer.

In summary the effects of nonprofit contracts are

dependent on market structure, and on how vigorously government enforces them. In a monopoly setting they have no effect unless there is strict enforcement, $\hat{r}$ is set at a low level, or demand is so small that the profit maximizing value of r is less than the no defection value. In a competitive setting, however, consumers always benefit from nonprofit contracts while the effect on firms is ambiguous.

At this point it is worth discussing barriers to entry to nonprofit markets. Aside from large capital expenditures, licenses, and fees faced by firms such as broadcasters, hospitals and nursing homes, there are other barriers to entry to markets served by nonprofit firms. United fund raising organizations tend to distribute only to large established institutions, and try to avoid duplication of services in a particular location. United Ways tend to admit an average of 1.5 new agencies a year.(Gaiter 1992)

The United Ways' cartel power is enhanced by the monopoly they tend to hold on payroll deductions; a monopoly that they have vigorously defended. In Los Angeles during the late 1970's the United Way and a local united fund engaged in a turf war that wound up in court. The suit that

AID, the local organization, filed claimed that the United Way aimed to "crush it out of existence". The United Way, AID claimed, told agencies it could not accept funds from AID and influenced chapters to cancel the AID plan. These actions cost AID 10 million dollars in donations. The dispute ended in a merger of the two groups.(Holguin 1979) In northern California local combined health agency drives filed an antitrust suit against the United Way accusing it of monopolizing payroll deductions.[1]

Nonprofit contracts themselves can also serve as a barrier to entry since the Internal Revenue Service is the official grantor of nonprofit status, although the hurdle is not too high. In 1990 52,654 organizations applied for tax exempt status. Of these 38,649 or 73 percent were approved. Less than 1 percent were denied.[2] An entrepreneur can theoretically set up an organization that provides a good or service typical of a nonprofit firm without obtaining official nonprofit status. There are many sectors where both

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[1]On the conservative distribution of funds by the United Way see Milofsky(1987) and Gaiter(1992). See Kendall(1976) and Luther(1978) for the LA charity war. See Banisk(1980) for the northern California suit.

[2]Annual Report of the Commissioner of the IRS(1990), Table 25, page 38.

types of firms exist. However, she would not benefit from the tax breaks and subsidies received by nonprofit firms. She would also not benefit from the signal that nonprofit status sends to donors.

Entry of for-profit firms into some sectors has been prohibited by law. Some states have passed laws allowing only nonprofit health maintenance organizations.(Hansmann 1981c p542) Corporate practice law also has prevented entry by for-profit firms into health fields. The reasoning has been that since only people with licenses can practice medicine, and corporations cannot hold licenses, corporations cannot practice medicine. Courts have applied this restriction only to for-profit corporations reasoning that the purpose of the law was to prevent the commercialization of medicine.(Hansmann 1981c p539)

Other regulatory bodies have been hostile toward the entry of for-profit corporations in certain sectors. In the 1930s several states passed Blue Shield Laws that regulated the formation of pre-paid health plans. These laws required that a state's medical society approve articles of incorporation of health plans. Thus, control of entry was

put into the hands of doctors, who also controlled one of the dominant firms in the market-Blue Shield.(Hansmann 1981c p 540)

Accrediting institutions have generally allowed only nonprofit schools. In 1970 Marjorie Webster Junior College sued the Middle States Association of Colleges and Secondary Schools Inc.(MSA) under the Sherman Act for conspiring in restraint of trade. Marjorie Webster was a closely held, for-profit corporation that MSA refused to consider for accreditation. Marjorie Webster won in district court but lost on appeal. The court felt that accreditation did not fall under the Sherman Act since it did not affect the commercial aspects of the profession.(Hansmann 1981c p545-547)

Competition, Fundraising, and Imperfect Information

Chillemi and Gui find that nonprofit contracts are a Pareto improvement because in their model firms earn zero profits in equilibrium. The stream of rents is a return on a sunk investment. Nonprofit contracts decrease the size of the rent stream and increase output so consumers are better

off. Firms still earn a normal return so they are no worse off.

A possible candidate for a sunk investment, brand name capital, was mentioned earlier. In this section I append sunk investments in name recognition to the model using an approach similar to Grossman and Shapiro(1984). In the model consumers are initially unaware of any firm's existence and have no means of searching for them. A firm invests in brand name capital through a fundraising campaign that informs consumers about its existence.

I assume there is a population of donors of unit size. Each individual has the following donation function

$$m_i = 1, \text{ if } r \leq \tilde{r},$$
$$m_i = 0, \text{ if } r > \tilde{r}.$$

There are n firms. At the beginning of the first period each firm engages in a fundraising campaign by soliciting a fraction s_i of the population. The campaign can be thought of as letters mailed to part of the population informing the recipients that the firm exists. Firms have no way of targeting donors so donors may receive solicitations from more than one firm. These mailings are sent only in the first period; in the subsequent periods donors and firms

engage in a donation game like the one described earlier. Donors never forget a firm exists.

The cost to a firm of mailing to a fraction s of the population is

$$C(s) = \frac{bs^2}{2} + f, \tag{4}$$

where b is a constant and f is a fixed but avoidable cost.

Suppose that all firms except for firm i solicit an equal fraction $\bar{s}$ of the population. The fraction that is reached only by firm i is then $s_i(1-\bar{s})^{n-1}$. In general the fraction reached by firm i and k other firms is

$$s_i\binom{n-1}{k}(1-\bar{s})^{n-k-1}\bar{s}^k.$$

If a fraction of the population is solicited by more than one firm it gives to the firm with the lowest r. If a number of firms have the same r, donations are divided equally among them. If all firms set $r=\bar{r}$ and the other n-1 firms set $s=\bar{s}$, then the revenue function of firm i is

$$s_i\bar{r}\sum_{k=0}^{n-1}\frac{1}{k+1}\binom{n-1}{k}(1-\bar{s})^{n-k-1}\bar{s}^k; \tag{5}$$

which can be reduced to

$$\frac{\bar{r}s_i}{n\bar{s}}\left[1-(1-\bar{s})^n\right]. \tag{6}$$

Thus firm i's revenue function is

$$R(r_i, s_i) = \begin{cases} r_i s_i (1-\bar{s})^{n-1}, & \text{if } r_i > \bar{r}, \\ \frac{\bar{r}s_i}{n\bar{s}}\left[1-(1-\bar{s})^n\right], & \text{if } r_i = \bar{r}, \\ r_i s_i, & \text{if } r_i < \bar{r}. \end{cases} \tag{7}$$

So its profit function is

$$\Pi_i(r_i, s_i) = R(r_i, s_i)\frac{1}{1-\delta} - \frac{bs_i^2}{2} - f. \tag{8}$$

Choose any period t>1 and assume all firms set $r=\bar{r}$. By this time fundraising costs are sunk so it pays a firm to lower its r by a tiny amount if $R(\bar{r}-\epsilon, s_i) > R(\bar{r}, s_i)$. This is true if

$$\frac{1-(1-\bar{s})^n}{n\bar{s}} < 1. \tag{9}$$

It's easy to show that this is always true for any n and $s\epsilon(0,1]$. Let $g(s)=(1-ns)-(1-s)^n$. Now $g(0)=0$ and $g'(s)=-n(1-(1-s)^{n-1})$; which is always less than 0 for $s\epsilon(0,1]$. So $(1-ns)-(1-s)^n<0$ for s in the above range; rearranging we get (9).

If all firms set r equal to $\bar{r}$ then it will pay for any firm to raise its r if

$$r_i s_i (1-\bar{s})^{n-1} > \frac{\bar{r} s_i}{n\bar{s}} [1-(1-\bar{s})^n] . \qquad (10)$$

Let r′ be the value of r_i that makes (10) an equality. If r′>r̃ then $\bar{r}$ is an equilibrium. On the other hand if r′≤r̃ Then each firm has an incentive to raise its r_i to r̃. Once all firms are at r̃ then each firm will want to lower its r_i. This leads to cycles in firms' r_i's.

Assume that the conditions for a stable equilibrium exist. Then it always pays for a firm to lower its r if the other firms hold theirs constant. Firms will continue to lower their r's until they hit the floor set by the no defection constraint. The competitive equilibrium is $r_i=1-\delta$ for all firms. If we use the approximation

$$(1-s)^n \approx 1 - ns + \frac{n(n-1)}{2} s^2 \qquad (11)$$

which is good for small s, the profit function for firm i, assuming firms are in the competitive equilibrium for all later periods, is

$$\Pi_i(s_i) = s_i[1 - \frac{n-1}{2}\bar{s}] - \frac{bs_i^2}{2} - f. \qquad (12)$$

Taking the derivative of (15) with respect to s_i and assuming a symmetric equilibrium we get the competitive level of

fundraising,

$$s_c = \frac{1}{b + \frac{n-1}{2}}; \quad \frac{\partial s_c}{\partial b} < 0, \quad \frac{\partial s_c}{\partial n} < 0. \tag{13}$$

The first partial derivative states that fundraising decreases with an increase in its marginal cost. The second states that an individual firm's fundraising expenditures fall if the number of firms increases. Changes in aggregate fundraising, ns_c, depend on the value of b. For $b<1/2$ aggregate fundraising decreases with entry. For $b>1/2$ it increases with entry.

The effect of entry on an individual firm's fundraising effort seems like common sense--an increase in n decreases the marginal productivity of fundraising. However, the reader is no doubt thinking of other situations where it seems competition raises fundraising expenditures. I point out the difference between informative fundraising, a firm letting potential donors know of its existence and mission, and rent dissipation. Increased competition means that instead of sending 2000 letters asking for a donation, a firm might send 1800 with a bumper sticker enclosed. The share of the population solicited falls but the line on the budget

for fundraising may increase.

Free Entry

If there are no artificial limits on the number of firms that may enter the market, firms will enter until profits are zero. Assuming firms set r at the competitive equilibrium and using the approximation given in (11), the no entry constraint is

$$\Pi_i(s_i) = s_i[1-\frac{n-1}{2}\bar{s}] - \frac{bs_i^2}{2} - f = 0, \ \forall i. \tag{14}$$

Assuming a symmetric equilibrium and using (13), the number of firms n_c and fundraising level s_c under competition are

$$\begin{aligned} n_c &= 1 - 2b + \sqrt{\frac{2b}{f}}, \\ s_c &= \sqrt{\frac{2f}{b}}. \end{aligned} \tag{15}$$

Taking the derivative of n_c with respect to b, we get

$$\frac{\partial n_c}{\partial b} = -2 + (2bf)^{-\frac{1}{2}};$$

the sign of which is indeterminate. An increase in the marginal cost of fundraising decreases profits and causes the number of firms in the market to fall. It also causes firms

to reduce the fraction of the population they solicit, which gives some elbow room for more firms to enter. The net change in the number of firms in the market depends on the relative magnitude of the two effects.

Social Optimum

The task of the social planner is to choose n and s to maximize the sum of consumer and producer surplus. The social welfare function is

$$W(n, s) = [1-(1-s)^n]\frac{1}{1-\delta} - \frac{nbs^2}{2} - nf; \qquad (16)$$

or

$$W(n, s) = [ns-\frac{n(n-1)}{2}s^2]\frac{1}{1-\delta} - \frac{nbs^2}{2} - nf. \qquad (17)$$

The first order conditions are

$$\frac{\partial w}{\partial n} = [s-\frac{2n-1}{2}s^2]\frac{1}{1-\delta} - \frac{bs^2}{2} - f = 0,$$

$$\frac{\partial w}{\partial s} = [n-n(n-1)s]\frac{1}{1-\delta} - nbs = 0. \qquad (18)$$

The optimal number of firms and fundraising level are

$$n_w = 1 - (1-\delta)b + \sqrt{\frac{(1-\delta)b-1}{2f(1-\delta)}},$$
$$s_w = \sqrt{\frac{2f(1-\delta)}{(1-\delta)b-1}}. \qquad (19)$$

It is a matter of simple algebra to show that s_c is always less than s_w; firms do too little fundraising in the competitive equilibrium. This is because the marginal benefit to a firm of reaching a new donor is $r/(1-\delta)$ while the marginal benefit to society is $r/(1-\delta) + (1-r)/(1-\delta)$. So the marginal private benefit is always less than the marginal social benefit. Whether there are too many or too few firms in the competitive market is uncertain as the following table shows.

Table 6.--Numerical Comparison:
Social Optimum and Competition

	δ=.9, f=.005			
	n_c	s_c	n_w	s_w
b=30	50	.018	42	.022
b=60	36	.013	66	.014

When the marginal cost of fundraising is high then it

is more efficient to have many firms each with a small fundraising level. With a low marginal cost of fundraising it is more efficient to have a smaller number of firms, each with a large fundraising level, to save on the fixed costs, f, involved.

Cartel Outcome

Suppose the organizations form a cartel and set up mutually exclusive shares of the population to solicit. Each firm's profit function is

$$\Pi_i(s_i) = \frac{\tilde{r}s_i}{1-\delta} - \frac{bs_i^2}{2} - f; \qquad (20)$$

where, recall, $\tilde{r}$ is the level above which donors stop giving. The value of s_i that maximizes (20) is

$$s_m = \frac{\tilde{r}}{b(1-\delta)}; \qquad (21)$$

and $n_m s_m = 1$.

Directly comparing the equations is not informative. Using the values for the simulation in table above, however, we can make some interesting comparisons seen in the following table.

Table 7.--Numerical Comparison:
Competition and a Cartel

δ=.9, f=.005, $\tilde{r}$=.5

	n_c	s_c	n_m	s_m
b=30	50	.018	6	.17
b=60	36	.013	12	.08

As the above table shows, a cartel dramatically reduces the number of firms and greatly increases fundraising.

With a cartel the entire population is solicited so gross donations equal one. Organizations retain $\tilde{r}$, so the amount of the good provided equals 1-$\tilde{r}$. In a competitive market the total amount of the good provided is the total fraction of the population solicited $n_c s_c$, multiplied by the fraction not retained by organizations, δ. The following table compares the amount of good provided per period and the total fundraising costs, from (4), in the competitive and cartel situations.

Table 8.--Numerical Comparison:
Competition and a Cartel

δ=.9, f=.005, $\tilde{r}$=.5

		Amount of Good Provided per period	Total Fundraising cost
Competitive	b=30	0.81	0.49
	b=60	0.42	0.36
Cartel	b=30	0.50	2.57
	b=60	0.50	2.24

Depending on the marginal cost of fundraising and $\tilde{r}$, the cartel provides more or less of the good than a competitive market, while the fundraising costs of the cartel are much greater.

The traditional justification for united funds is that they lower fundraising costs by eliminating costly overlap of effort. This example shows this to be the case, but the elimination of overlap increases the marginal value of fundraising so the total spent might increase. This conclusion may be reversed if fixed costs are a larger share of total cost.

Even though more of the population gives if there is a cartel, by eliminating competition managers are free to pay

themselves more so the total amount of the good provided may be less than in a competitive market.

Nonprofit contracts

As before, I model nonprofit contracts as a cap on the potential gain from defection. The profit function of a representative firm in a competitive market with nonprofit contracts is

$$\Pi_i(s_i) = s_i\left[1-\frac{n-1}{2}\bar{s}\right]\hat{r} - \frac{bs_i^2}{2} - f. \tag{22}$$

Since nonprofit contracts drive an even greater wedge between the marginal private benefit of fundraising and its marginal social benefit it is reasonable not to be too optimistic about their effect. The number of firms and fundraising level with nonprofit contracts in a competitive market are

$$n_c = 1 - \frac{2b}{\hat{r}} + \sqrt{\frac{2b}{f}},$$
$$s_c = \sqrt{\frac{2f}{b}}. \tag{23}$$

Nonprofit contracts have no effect on the equilibrium fundraising level. This is no surprise since with free entry

the fundraising level is determined by zero profits, which implies that marginal cost must equal average cost in equilibrium. The more vigorously nonprofit contracts are enforced, the lower $\hat{r}$, the fewer firms are in the market.

There is the possibility that nonprofit contracts will improve total welfare when there are too many firms in the market. For this to be so

$$\frac{\partial W}{\partial \hat{r}} = \frac{\partial W}{\partial n}\frac{\partial n}{\partial \hat{r}} < 0;$$

that is lowering $\hat{r}$ must increase W. Now $\partial n/\partial \hat{r}$ is always positive so for the above inequality to hold $\partial W/\partial n$ must be less than zero. However, look at the case given on the first line in Table 6. $n_c > n_w$ so there are too many firms in the market. Yet if the values given are substituted into the first order conditions given in (18), we find that $\partial W/\partial n > 0$. So even though there are more than the optimal number of firms in the market, decreasing their number lowers welfare.

What is happening can be easily shown in a diagram--Figure 1. W_n is the locus along which $\partial W/\partial n = 0$, and W_s is the locus along which $\partial W/\partial s = 0$. Where the two intersect is the social optimum. The competitive equilibrium is at the intersection of the profit maximizing locus $\Pi' = 0$ and the no

entry constraint $\Pi=0$.

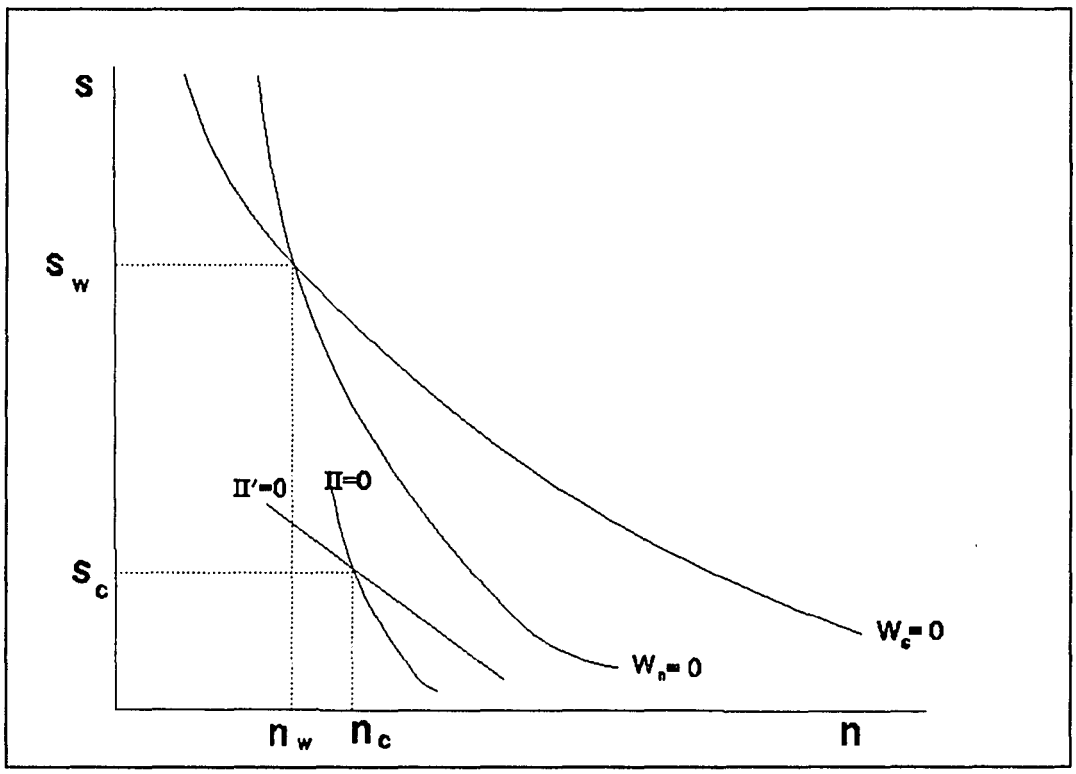

FIGURE 1--Competitive and Optimal Equilibria

Although $n_c>n_w$, if additional firms enter total welfare moves toward a local optimum on the W_n locus. Decreasing n moves total welfare away from this optimum. A social planner would have to be very careful indeed to use nonprofit contracts as an entry controlling mechanism.

A possible benefit of nonprofit contracts is that they make it possible for an equilibrium to exist when there otherwise might be cycles in firms' r_i's. For this to be the case $\hat{r}$ must be less than r'.

Conclusion

This paper compares two methods of regulation organizations that receive lump-sum donations: private monitoring combined with donor threats to stop giving if an organization's management misbehaves, and government monitoring in the form of nonprofit regulation. The simple model shows that even without nonprofit contracts donors will give and the good will be produced. Nonprofit contracts might cause more of the good to be provided and eliminate cycles. However unless the government monitors firms closely, setting a very low $\hat{r}$ in the model, competition and private monitoring is still necessary for donors to benefit.

In some industries nonprofit regulation may benefit consumers only through active and costly government supervision. A more cost effective strategy may be to foster competition by lowering barriers to entry. Pro-competitive actions may include easing regulatory and licensing procedures or breaking monopolies on payroll deduction plans.

Chapter 3

AN EMPIRICAL STUDY

This chapter presents an empirical test of the model developed in the previous chapter. The effects of competition on the fraction of total revenue spent by nonprofit organizations on services and management are examined using data for nonprofit organizations in the state of California. The results are mixed. Increased competition does increase the fraction nonprofit organizations spend on services, but it also increases the fraction spent on management.

This study is based on work done by Feigenbaum. (1980, 1987) but extends it in important directions. Feigenbaum's 1980 work was an inter-industry study using industry averages for its observations. The later paper used firm level data but only examined the medical charity sector.

This chapter presents an inter-industry study using organization level observations. Whereas Feigenbaum looked at nineteen sectors, I look at twenty-six. Feigenbaum's data covered seven metropolitan areas, while this study uses data

from the entire state of California: major cities and rural areas as well. In sum, this study represents a substantial increase in scope and detail over previous work.

Previous Work

The concentration of organizations in a market is used as a proxy for competition. The concentration-profits study is a time-honored methodology started by Bain.(1956) Weiss(1971) surveys forty-six different studies and adds a forty-seventh. He concludes that this large body of work generally supports the theoretical prediction of a negative relationship between the number of firms in an industry and firm profits. This relationship holds not only for the United States but for Britain, Canada, and Japan. It seems to break down in periods of high inflation.[1]

Few studies have applied this methodology to nonprofit organizations. As mentioned before, Feigenbaum conducted both inter- and intra-industry studies of the effect of concentration on the fraction of revenue nonprofit firms spend on fundraising, administration, and services. The

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[1]Weiss(1971) p. 231.

inter-industry study examined 19 different sectors served by nonprofit organizations across seven cities and four years. Feigenbaum found that concentration had a negative effect on the fraction spent on services. This is what to expect if competition among nonprofit organizations causes them to increase output. However, concentration had a negative effect on the average fraction spent on management. This contradicts the hypothesis that nonprofits compete like their for-profit counterparts since management is the logical place for a nonprofit organization's management to spend its rents.

In an intra-industry study of the medical charity sector Feigenbaum again found a negative relation between concentration and the fraction spent on services. The study also found a positive relation between concentration and the fraction spent on administration. Concentration also had a negative effect on the fraction spent on fundraising.

Clark(1991) studied the effects of competition on nonprofit nursing homes. The effect of concentration measured by the Herfindahl index had no significant effect on revenues and the number of patients served by a home. The number of facilities in a market, however, had a negative

effect on both. An increase in the number of facilities also reduced the level of cross-subsidization done by the homes. Another indication that competition reduces rents in the nonprofit sector.

The Model

The theoretical relations tested here follow those tested by Feigenbaum(1987):

$$y=f(\text{revenue, age, concentration})$$

$$r=g(\text{revenue, age, concentration})$$

$$s=h(\text{revenue, age, concentration});$$

y is the fraction of total revenue spent on services, r is the fraction of total revenue spent on management, and s is the fraction of total revenue spent on fundraising. These fractions are not inclusive of all revenue received by an organization. There may very well be a positive or negative residual that causes a change in the organization's net assets.

Management expenditures includes not only the essential secretaries, phone services, and paper clips needed to run the place but, since managers cannot directly pay themselves

any profits, it also includes inefficiencies and padding that are indirect payments to management. So this variable is used as a proxy for 'profits' gained from decreased competition.

The fraction spent on services is used as a proxy for output. It is clearly an input measure and so cannot directly measure how successful an organization actually is in fulfilling its mission or satisfying donors.

Revenue. Feigenbaum hypothesized that monitoring of an organization by the government and donors increases with its size. Small organizations are not required to report to the IRS and large organizations may engage in highly visible, large-scale projects that are easier for patrons to monitor. Consequently revenue should have a positive effect on the fraction spent on services and a negative effect on the fraction spent on management.

Economies of scale in fundraising and management also imply that total revenue has a negative effect on the fraction spent on these two purposes. This hypothesis should be tempered by the discussion in the previous paragraph. Since larger firms may be monitored more closely, managers

have a harder time capturing the benefits form any efficiency gains, and therefore have little incentive to find them.

Age. An older organization will have greater name recognition and so may be perceived to be more trustworthy, and so monitored less, by the government and its patrons. Greater name recognition may also mean that it does not have to spend as much on fundraising. Age, then, will have a negative effect on the fraction spent on services and fundraising, and a positive effect on the fraction spent on management.

Concentration. Managers in less concentrated markets, facing less competition, will be able to spend more money on themselves than on services. Therefore, concentration will have a negative on the fraction spent on services and a positive effect on the fraction spent on management.

The effect of concentration on fundraising is uncertain. The model in the previous chapter demonstrated that greater competition leads to less per-firm spending on fundraising. In that case, however, the only function of fundraising was to inform potential donors of a firm's existence. Fundraising may also be a means to transfer rents back to

donors, in which case fundraising expenditures increase with greater competition. The overall effect of concentration on fundraising depends on the relative magnitude of these two opposite effects.

The Test

The data used to test the above relationships came from the Charitable Trusts Master File kept by the Registry of Charitable Trusts of the Office of Attorney General of the State of California. The file contains entries for every nonprofit organization that operates in California except for some that are exempt from having to register. Each entry contains information from the organization's IRS form 990 and California form CT-2.

The study used organizations with classification codes AD, CD, ED, MD, OD, and D. These classifications include California corporations, unincorporated associations, community foundations, and other organizations that are not private foundations or trusts. The sample included all organizations that had filed a return after December 1990. The actual equations estimated were:

$$PCTSERV_i = \alpha_0 + \alpha_1 \frac{1}{TOTREV_i^2} + \alpha_2 YR_i + \alpha_3 HERF_i + \delta_1' D_i + \epsilon_1,$$

$$PCTMGMT_i = \beta_0 + \beta_1 \frac{1}{TOTREV_i^2} + \beta_2 YR_i + \beta_3 HERF_i + \delta_2' D_i + \epsilon_2,$$

$$PCTFUND_i = \gamma_0 + \gamma_1 \frac{1}{TOTREV_i^2} + \gamma_2 YR_i + \gamma_3 HERF_i + \delta_3' D_i + \epsilon_3,$$

$$E(\epsilon_i) = 0, \ \forall i.$$

$TOTREV_i$ is an organization's total revenue taken from line 12 of its Form 990. $PCTSERV_i$ is the amount organization i spent on program services, line 13 Form 990, divided by its total revenue. $PCTMGMT_i$ is the amount organization i spent on management, line 14 Form 990, divided by its total revenue. $PCTFUND_i$ is the amount an organization spent on fundraising, line 15 Form 990, divided by its total revenue.

The problem with using the amount spent on services as a measure of output has already been touched upon. $PCTMGMT_i$ is also an imperfect measure of its theoretical counterpart. Although this entry includes salary for the chief officer and staff, if the chief officer spends time directly supervising services or fundraising, as is likely in a small organization, then some of her salary may be allocated to these categories as well. $PCTMGMT_i$, then, may not reflect the full compensation paid to the chief officer and other

members of management. Services and fundraising may also include other expenses that benefit an organization's management.

Fundraising expenses include funds spent on conducting fundraising campaigns and soliciting grants and bequests. It does not include expenses incurred selling merchandise for profit, for special fundraising events, from rental income, or from selling assets. So $PCTFUND_i$ underestimates the fraction an organization spends on fundraising.

Plots of the dependent variables versus TOTREV showed an inverse relationship. Experimentation with functional forms revealed that using $1/TOTREV_i^2$ gave the best fit, so this functional relationship was incorporated in the final estimations.

There was an apparent increase in variance in the observations and some extreme outliers at low values of TOTREV. To prevent these observations from corrupting the results the sample included organizations whose total revenue was above $25,000. This level was chosen somewhat arbitrarily by examining plots of the data but it also corresponds to the cutoff level for filing with the IRS. It

may be that some of the extreme outliers, some as high as 5000 percent of total revenue, were organizations who normally receive revenues greater than $25,000 but filed anyway out of habit. The fact that many of these organizations spent more than they took in that year may indicate that they are following some multi-year spending plan or are subject to a version of the permanent income hypothesis. If true, then the simple model developed and tested in this dissertation may have a serious gap and be unable to predict nonprofit firm behavior.

YR_i is the date the organization was established. Since YR_i is related inversely to age the signs of its coefficients in the above equations are posited to have the opposite signs than those predicted for age in the previous section.

$HERF_i$ is the concentration of the market served by firm i as measured by the Herfindahl-Hirschman index:

$$HERF_i = \sum_{j=1}^{n_i} s_{ij}^2;$$

where s_{ij} is 100 times the fraction of total revenue of all firms in the same market as i received by firm j. The index is a sum of these fractions over all firms j in the market.

A market is defined as a group of nonprofit organizations in the same sector located in the same geographic region. Organizations were divided into sectors by their primary purpose codes. These purpose codes are three digit numbers used by the state of California to classify nonprofit organizations. Organizations with similar purposes, such as funds organized to combat various diseases, were aggregated into larger sectors. Table 9 shows the sectors used in this study, the purpose codes they encompass, and the distribution of organizations in the sample among sectors.

Markets were defined geographically by county although some counties were aggregated into Metropolitan Statistical Areas following the Census Bureau. Table 10 shows the distribution of organizations by geographic location.

This division of organizations into markets is admittedly somewhat arbitrary. Although extensive research has been done on the giving habits of donors, see Jencks(1987) for a review, it has focussed on the effects of tax treatment of donations, income, race, and gender on giving. Research on what types of organizations donors give

Table 9.--Distribution of Organizations by Sector

Sector	Purpose Codes	Percent of Organizations
Service Clubs	43	1.10
Veterans Org.	44	0.96
Animal Welfare	103	1.65
Benefits to Individuals	101, 102, 104-108 110-112	28.10
Civic Improvement	121	3.16
Ecology	123	1.40
Crime Prevention and Juvenile Delinquency	122	0.75
Intercultural Relations	124	0.23
Historic/Patriotic	125,6	1.15
Museums	127	1.28
Fine Arts	128,9 131	6.85
Transportation and Safety	130	0.50
General Charitable Purposes inc. United Funds and Red Cross	141-45	7.60
Religious	201,2 211,12 221,22 231,32 241	3.24
Financial Assistance to Schools, Students	301,2,3	4.39
Special Education	304,5,8 315 316	4.01
Vocational Training	309	1.28
Promotion of a Particular Purpose through Education	311	4.96

Table 9.--continued

Sector	Purpose Codes	Percent of Organizations
Organized Youth Activities	313	4.65
Recreation	312	1.46
Libraries	314	0.51
Research	306 321-324	2.65
Hospitals and Clinics	401	1.94
Other Medical	402-405	7.13
Specific Diseases	411-433 440	7.45
International Activities	501-509	1.60

Table 10.--Distribution of Organizations by Geographic Location

Location	Percent of Orgs.	Location	Percent of Orgs.
Amador	.05	Oakland PMSA Alameda Contra Costa	9.44
Butte	.64	Orange	6.00
Calaveras	.09	Plumas	.16
Colusa	.03	Riverside-San Bernardino PMSA Riverside San Bernardino	5.34
Del Norte	.09	Sacramento MSA El Dorado Placer Sacramento Yolo	6.08
Fresno	1.63	Santa Barbara	2.16
Glenn	.02	San Benito	.08
		Santa Clara	5.41
Humboldt	.87	Santa Cruz	1.29
Imperial	.26	San Diego	7.36
Inyo	.12	San Francisco PMSA Marin San Francisco San Mateo	13.65
Kern	1.18	Shasta	.62
Kings	.12	Siskiyou	.23
Lake	.20	San Joaquin	1.14
Lassen	.03	San Luis Obispo	.68
Los Angeles	25.46	Sonoma	1.66
Madera	.09	Stanislaus	.86

Table 10.--continued

Location	Percent of Orgs.	Location	Percent of Orgs.
Mariposa	.01	Trinity	.06
Mendocino	.62	Tehama	.06
Merced	.28	Tuolumne	.19
Modoc	.05	Tulare	.65
Mono	.06	Vallejo-Fairfield-Napa PMSA Napa Solano	1.35
Monterey	1.70	Ventura	1.33
Nevada	.30	Yuba MSA Sutter Yuba	.30

Table 11.--Descriptive Statistics of Sample Variables

	Mean	Standard Dev.
PCTSERV	.7521	.3536
PCTMGMT	.2147	.3785
PCTFUND	.0886	.1789
TOTREV	2,013,440.86	11,377,655.58
YR	1970.58	17.11
HERF	2225.17	2299.96

to has dealt only with broad categories. So, there is no way of being certain about how a donor in Long Beach views a local charity versus one in San Francisco or New York; or how close a substitute a food bank is to the Boy Scouts.

Descriptive statistics for the variables used are given in Table 11.

The Results

The equations were initially estimated with a vector D_i of dummy variables for location and sector. The location variables had no significant effect so the final estimates only include dummy variables for sector with the benefits-to-individuals sector used as the baseline. The equations were also estimated using the four-firm concentration ratio as a alternate measure of concentration but the variable had no significant effect. Since inspection of the data plot and statistical tests indicated that the error terms were heteroskedastic, the equations were estimated using weighted least squares with TOTREV as weight.

Since missing values were coded as zero in the data set the equations were estimated omitting observations where the

Table 12.--Regression Results

	Dependent variables		
	PCTSERV	PCTMGMT	PCTFUND
Intercept	-.07957** (2.815)	-.2569 1.150	-.2366 1.394
$1/TOTREV^2$	8195465 (.058)	740428391** (6.515)	643272291** (4.648)
YR	.00083** (5.774)	.00019* (1.708)	.00015* (1.728)
HERF	-.0000059** (4.277)	-.0000067** (5.942)	-.0000014 (1.514)
Adj. R^2	.0713	.0713	.0644
N	6410	5901	2393

Absolute value of t statistics in parentheses.
** Significant at the .01 level, 2-tailed.
* Significant at the .10 level, 2-tailed.

Table 13.--Predicted v. Estimated Effects

Independent variable	Dependent variable	Predicted effect	Estimated Effect
PCTSERV	$1/TOTREV^2$	-	Not significant
	YR	+	+
	HERF	-	-
PCTMGMT	$1/TOTREV^2$	+	+
	YR	-	+
	HERF	+	-
PCTFUND	$1/TOTREV^2$	+	+
	YR	+	+
	HERF	?	Not significant

value of the dependent variable was zero.

The results of the estimations are given in Table 12. Table 13 compares the signs of the coefficients predicted by the model with the signs of the estimated coefficients. Although the adjusted R^2 cannot be given the traditional interpretation due to using weighted least squares to estimate the equations, they are reported anyway to give the reader some diagnostic measure for how well the model explained the data. The estimates for the coefficients of the sector dummies are not given to save space.

Although the model explains very little of the variation Table 13 shows that by-and-large the included variables have the predicted effects.

Revenue. Revenue is inversely related to the fraction spent on fundraising, supporting the hypothesis that there may be economies of scale. It is also inversely related to the fraction spent on management expenditures but not to the fraction spent on service. This lends some support to economies of scale in management but only partial support to the hypothesis that large firms are watched more closely.

Age. Older organizations spend a smaller fraction of revenue

on fundraising and services. The effect of age on management expenditures is significant, but has the wrong sign.

Concentration. The effects of concentration are mixed. Organizations in more concentrated markets spend less on services, but the effect is minuscule. The effect of concentration on management expenditures is significant, but has the opposite sign than predicted. The effect on fundraising is not significant but recall that its predicted effect was uncertain.

Conclusion

This chapter tested whether nonprofit organizations compete in the same way as for-profit firms. The results did show that more concentrated industries, assumed to be less competitive, spend a smaller fraction of revenue on services. What managers do with the extra money in unclear since concentration also has a negative effect on the percentage of revenue spent on management. This contradicts the model since management expenses were posited to be the way managers pay themselves the increased 'profits' due to less competition.

Since concentration had no significant effect on fundraising, where the money went is a small mystery. One possible explanation is a change in the organizations' net savings. This is consistent with the observation mentioned earlier that some firms spent over 100 percent of their revenue on certain classes of expenditures. This is to be expected since the financial reports are from the years 1991-92, a period when the economy was quite sluggish.

This study adds to a small body of work that has shown that the standard models of competition can be applied to nonprofit organizations. The evidence is strong but not overwhelming since there is the occasional wrong sign and the results appear to be sensitive the measure of concentration used. The concentration study has probably yielded all that it can. Further tests of the model need more detailed micro-data on how managers of nonprofit firms make decisions.

Chapter 4

EXPERIMENTAL TESTS

This chapter reports the results of ten experiments that test the model presented in Chapter Two. Recall that the main conclusions of that chapter were:

1. Nonprofit contracts are not necessary to solve the principal-agent problem caused by unrestricted donations;

2. Nonprofit contracts, however, might make consumers better off; and

3. The number of firms matters in a market for a public good as in any other.

These hypotheses were tested in a controlled laboratory setting with individual subjects assuming the roles of donors who benefit from a public good, and sellers of the good. Although the third hypothesis was tested using field data in the previous chapter, the laboratory is the ideal place to test the effects of institutional change predicted by the first two hypotheses. The experiments give broad support to all three predictions, with two interesting corollary

observations. First, subjects did not play the grim trigger strategy outlined in Chapter Two. Second, in this environment, at least, the effect of competition was much more dramatic.

Procedure

The foundation for these experiments was the basic voluntary contributions experiment (Isaac, Walker, and Thomas; Kim and Walker). Each experiment consisted of four donors whose task was to divide up an endowment of tokens between a public and a private good. They repeated this decision over several periods. However, unlike past voluntary contributions experiments, instead of purchasing the public good directly from the experimenter, each donor had to purchase the public good from an agent of their choice. This agent had the option of deducting any fraction from 0 to 100 percent in increments of 10 percent of the donations for her personal consumption. The remainder was used to purchase the public good. Four experiments had four endogenous sellers of the public good and four had endogenous monopoly sellers.

Two experiments were baselines with the public good provided by the experimenter. The purpose of these experiments was to determine if the experimental design or parameters caused behavior different from previous voluntary contributions experiments.

The nonprofit contract was modeled by giving sellers the option of making a binding precommitment as to the fraction of tokens they would deduct. If a seller chose to make a precommitment it was announced to all subjects before the donors made their investment decision. In half of the experiments sellers had this option for the first eight periods of the experiments; in the other half they were given the option starting with period nine. The regime change was announced at the beginning of the first period of the change. Table 14 gives the breakdown of experiments into treatment cells.

The experimental design and procedure is given in Table 15. Sellers and donors were not told each others' payoff information or endowments. Donors were informed that the sellers were paid different rates for tokens invested and passed through. The actual rates and their relative

Table 14.--Experiments Conducted

	Number of Sellers		
Binding precommitments permitted (Sequence B)	Competitive (4 Sellers)	Monopoly	Baseline (no sellers)
Periods 1-8	NPC3BA[a] NPC4BA	NPM3BA NPM4BA	
Periods 9-end	NPC1AB NPC2AB	NPM1AB NPM2AB	
Not Applicable			NPB1 NPB2

a. The experiments are designated with the following code: NP-nonprofit; C(ompetitive), i.e. four sellers, M(onopoly), B(aseline); the number of the experiment; and AB or BA. Under condition B sellers could make binding precommitments; under A they could not. So, for example, AB indicates that sellers could not make precommitments for the first eight periods of the experiment, and were able to make commitments for the remainder of the experiment.

Table 15.--Experimental Design and Procedure

I. Subject Characteristics
   A. Undergraduates from the University of Arizona recruited from economics classes

   B. Donors
      1. **Number**: four in all experiments
      2. **Endowment**: 12 tokens per buyer per period
      3. **Payoffs**:
         a. Private investment-100 experimental dollars for each token invested
         b. Public investment-see payoff schedule in the appendix

   C. Sellers
      1. **Payoffs**:
         a. 0.50 experimental dollars per token sent through to the group investment
         b. 1.00 experimental dollar per token deducted
      2. **Deductions**
         a. Sellers restricted to deducting in even multiples of 10 percent from 0 to 100 percent i.e. 0%, 10%, 20%, ...
         b. Each period sellers are restricted to deducting the same percentage from all donors who purchase through them

II. Procedure
   A. Sequence of actions
      1. Sellers who wish to announce a binding deduction rate do so. Those who don't announce 'no'. Rates announced to all subjects. (Sequence B only)

      2. Donors make their investment decisions, designating a single seller as an agent

      3. Sellers receive orders and decide what fraction of donations to deduct if not previously announced.

      4. Fractions deducted by sellers and the net amount invested in the group exchange announced to all subjects

   B. Length of Experiment: at least 16 periods. At the end of period 16 and every subsequent period a card was drawn from a deck consisting of Ace through five of each suit. If a five was drawn the experiment continued.

magnitude were unannounced.

When designing the experiments I was concerned about the making the principal-agent problem too formidable; perhaps demonstrating too little faith in my own theory. Therefore, payoffs were designed to mitigate the problem as much as possible. Sellers were paid a significant amount for the tokens sent to the public good. The payoff to donors from the public good was substantial compared to the private good. Also, the total benefit of the public good above 24 units was constant to lower the risk of overprovision.

Another reason sellers were paid for the tokens they sent through to the public good was because a folk theorem among experimental economists says that subjects usually have to be compensated a positive amount, usually quite small, for the psychic costs of making decisions. These costs can keep subjects away from an equilibrium where one party receives a zero return, as when a seller decides to deduct zero tokens. Therefore, to compensate sellers for these costs at a level of zero deductions, they were paid for the tokens they did not deduct.

The payoff donors' schedule from the public good is

given in the appendix. The payoff for the public good has four focal points with positive amounts of the public good provided: the efficient level at 20 units; the Nash equilibrium level at 16 units; the level of maximum total benefit at 22 units; and the end of the payoff schedule at 24 units. In addition there is the security payoff of 0 units provided.

The donors' payoffs were designed to separate the five focal points. Unfortunately, in order to keep the table tractable for subjects to use it was not possible to put as much space between them as might be desired.

As is evident in Table 15 donors and sellers were paid quite differently in nominal terms. The exchange rates were adjusted across subjects and treatments so that subjects would make $15 to $20 in an experiment.

At the beginning of the experiment the instructions were read aloud to the subjects. Subjects then worked through a practice exercise on how to calculate their payoffs. They then went through a trial period that did not count toward their earnings to ensure that they understood the sequence of events in a period. The experiments were hand-run and

lasted from 1/2 an hour for the baseline experiments to 1-1/2 to 2 hours for the others.

Equilibria

The competitive equilibrium assumes sellers attempt to attract donations by lowering the fraction they deduct. The fraction is then bid down to the no defection constraint. To solve for it we start with period t>16. A seller who receives a donation m_t has the option of retaining the entire amount or deducting a fraction r<1.00 and receiving the payment $rm_t+(1-r)m_t/2$. There is also the probability p=.20 of receiving the same amount in the next period; p^2=.04 the period after etc. The total expected payoff for not defecting is

$$\frac{rm_t+(1-r)m_t/2}{1-p}$$

Suppose donors play the trigger strategy. If a seller keeps the entire donation for a single period, r=1, then she will receive m_t that period a zero for the remaining periods. In equilibrium, the subject is indifferent between the two choices; so if she is risk neutral

$$m_t=\frac{rm_t+(1-r)m_t/2}{1-p};$$

which gives a value for r of 0.6.

This is an equilibrium for $t \geq 16$. For $t \leq 15$ if a seller receives a donation of m_{15} she prefers deducting the fraction r rather than the entire amount if

$$m_{15} \leq r_{15} m_{15} + (1 - r_{15}) m_{15}/2 + m_{16},$$

or

$$m_{15}(1 - r_{15}) \leq 2m_{16}.$$

Let M_t be the total donations given to all sellers in period t and assume every seller receives a constant fraction of total donations every period. Then the above equations hold for M_{15} and M_{16}. Substituting and solving gives $M_{16}=27$ and 10.8 units of the public good provided. In period 15, $r_{15}=0$, $M_{15}=16$ and 16 units of the public good are provided. The competitive equilibrium with no binding precommitments is then

$$r_t=0, \quad M_t=16 \quad \text{and} \quad Q_t=16, \quad \text{if } t \leq 15;$$

$$r_t=.6, \quad M_t=27 \quad \text{and} \quad Q_t=10.8, \quad \text{if } t \geq 16.$$

If sellers can precommit the competitive equilibrium is $r_t=0$ and $M_t=16$ for all t. Since the no defection constraint derived above is not binding, a monopolist is free to maximize her total payoff. This point, the monopoly

equilibrium, is 80 percent deducted and 8 units of the public good provided.

Results

Aggregate Results

The results of the experiments are graphed in figures one through nine. Figure One shows the two baseline experiments. In the other figures the dotted line represents the total number of tokens contributed toward the public good by the donors. The solid line represents the actual amount of the public good provided.

Cursory inspection of the graphs leads to the following observation.

Observation one. The level of public good provision is much more volatile with endogenous sellers than in the baseline experiments.

In both baseline experiments contributions start at or above the efficient amount of the public good and fall off gradually. This result is consistent with previous public good experiments. Except for some parts of experiments NPC2, NPC4, and NPM3 the experiments with endogenous sellers show

FIGURE 2--NPB1 and NPB2

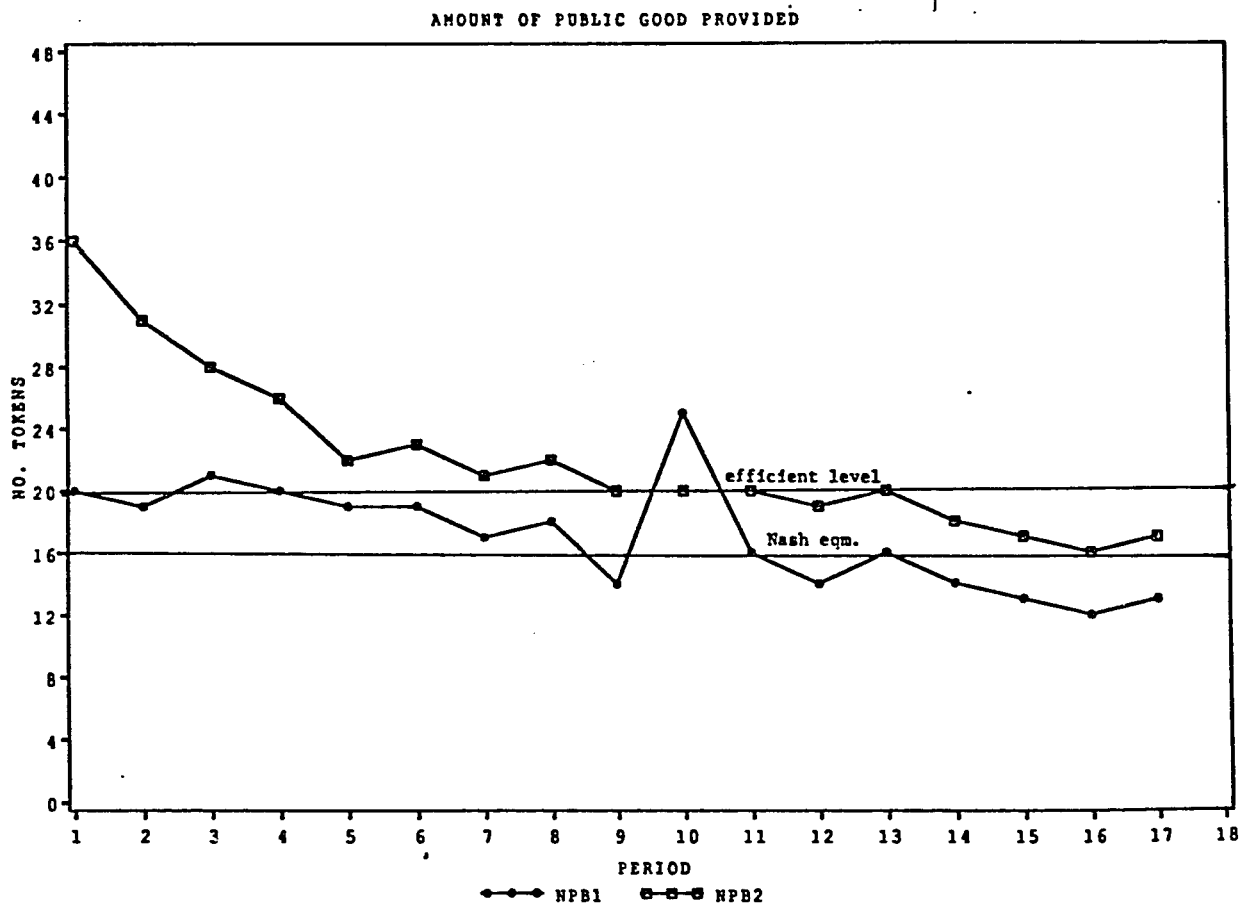


FIGURE 3--NPC1AB

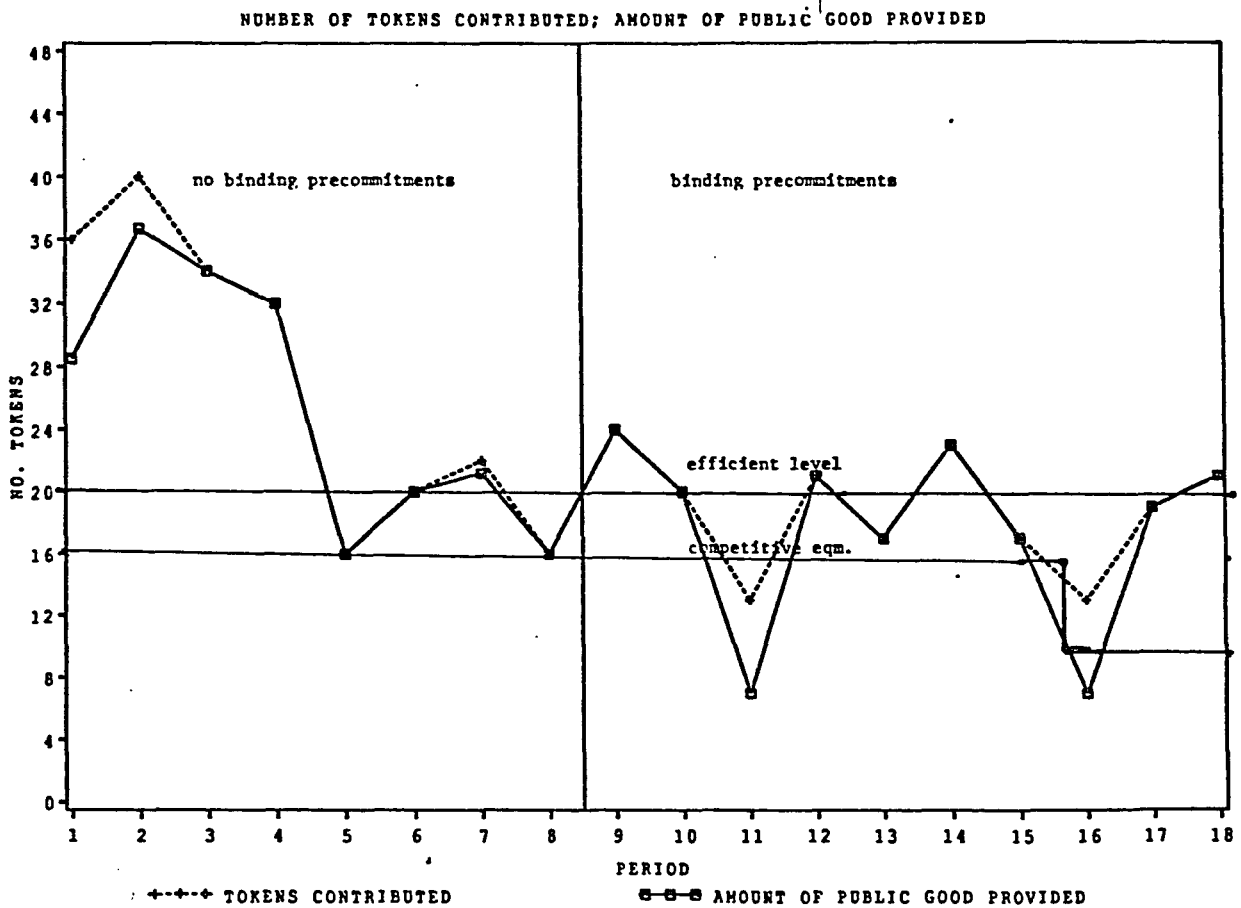


FIGURE 4--NPC2AB

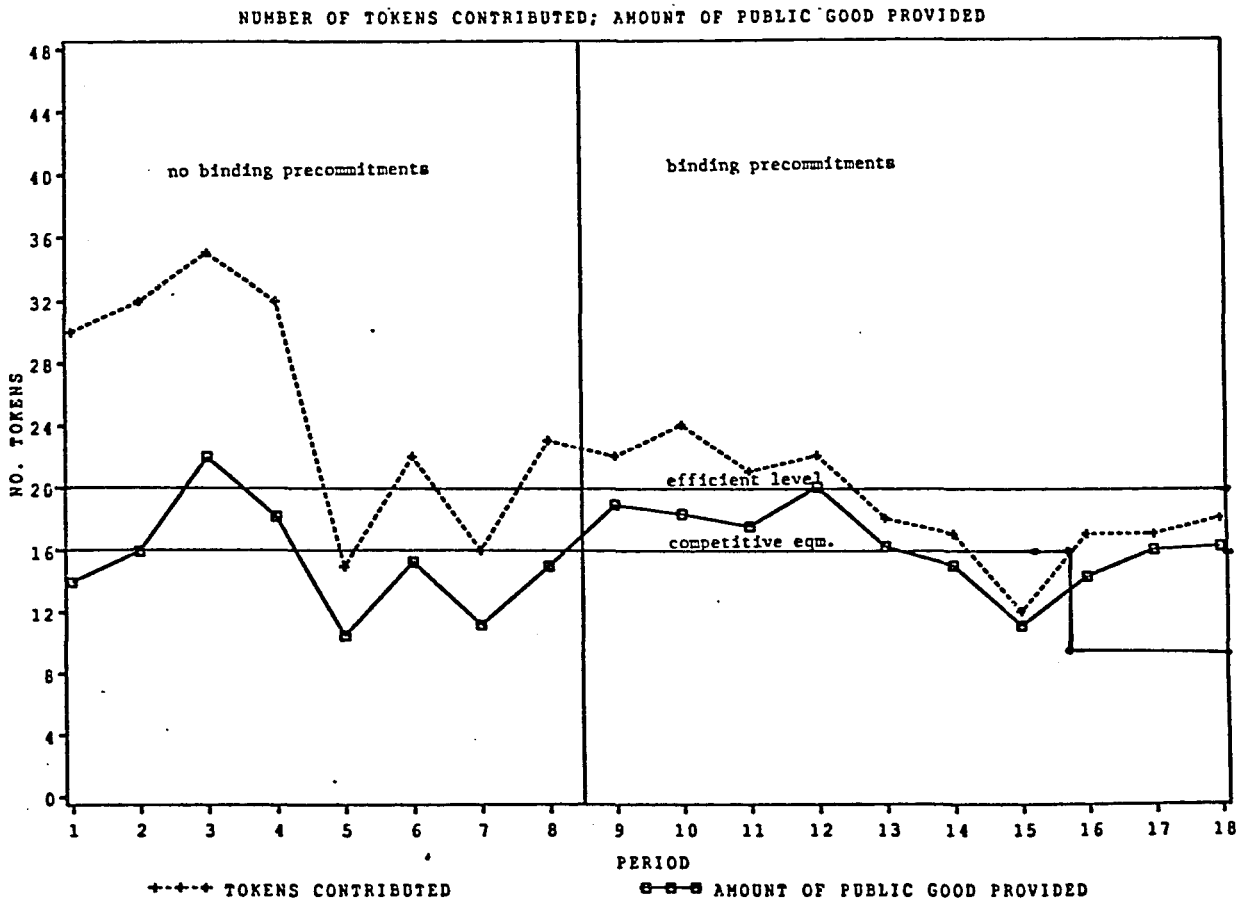


FIGURE 5--NPC3BA

NUMBER OF TOKENS CONTRIBUTED; AMOUNT OF PUBLIC GOOD PROVIDED

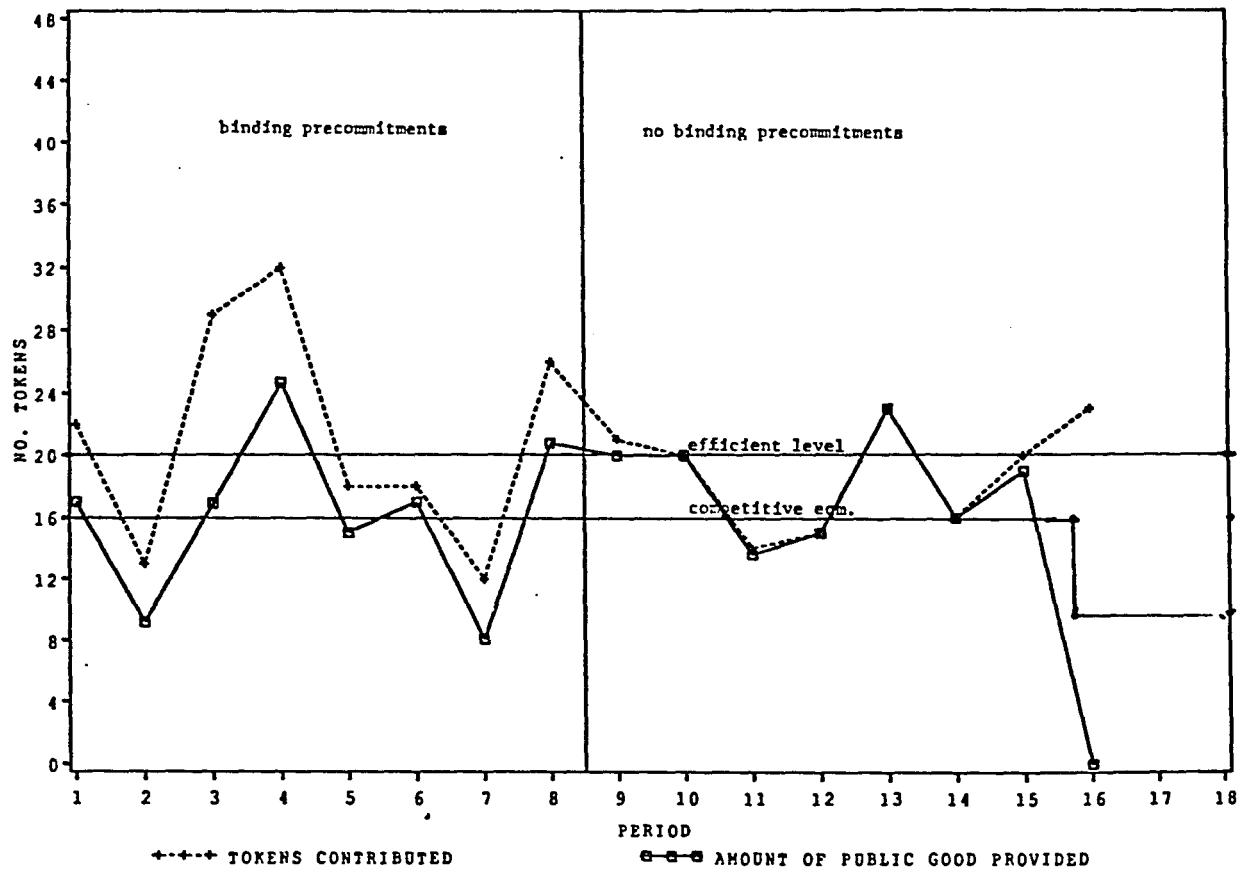


FIGURE 6--NPC4BA

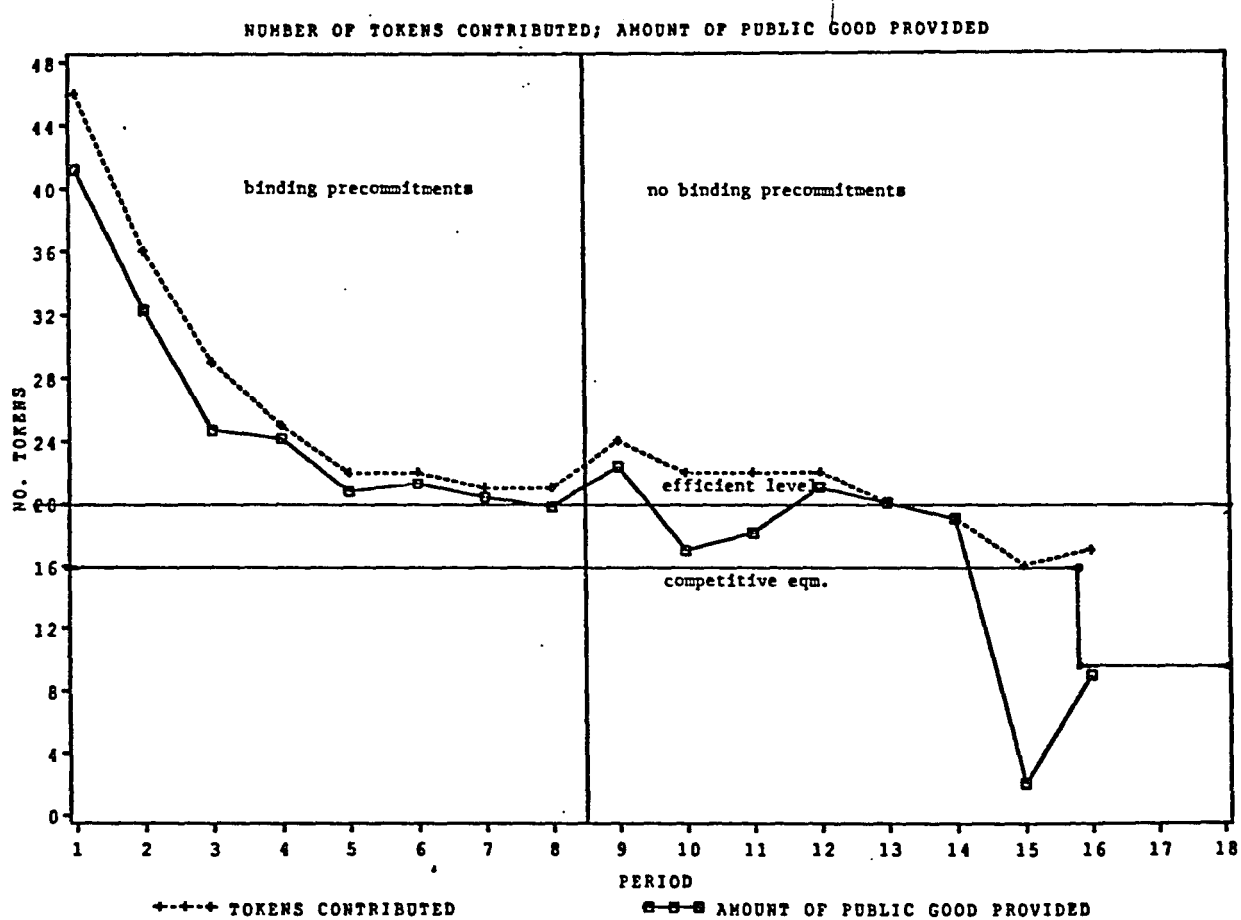


FIGURE 7--NPM1AB

NUMBER OF TOKENS CONTRIBUTED; AMOUNT OF PUBLIC GOOD PROVIDED

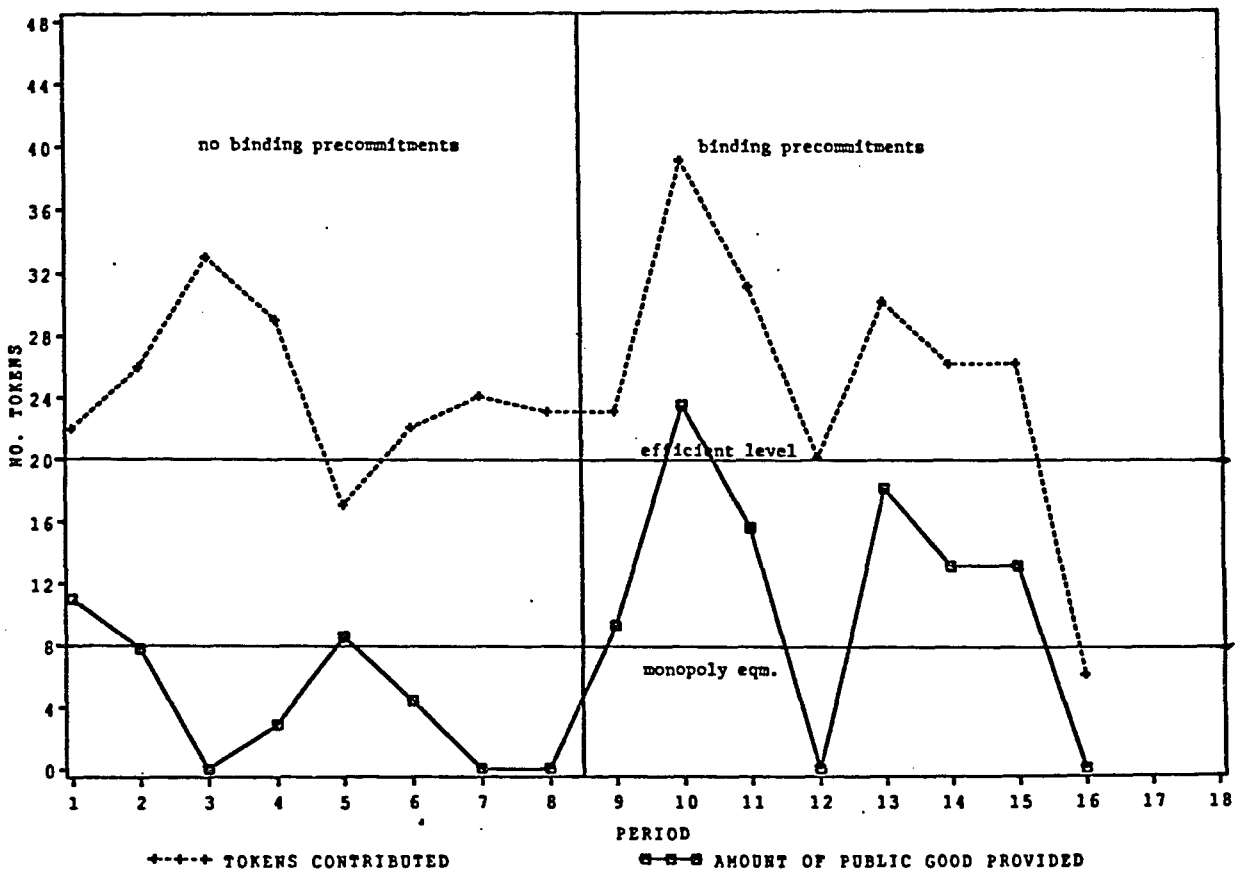
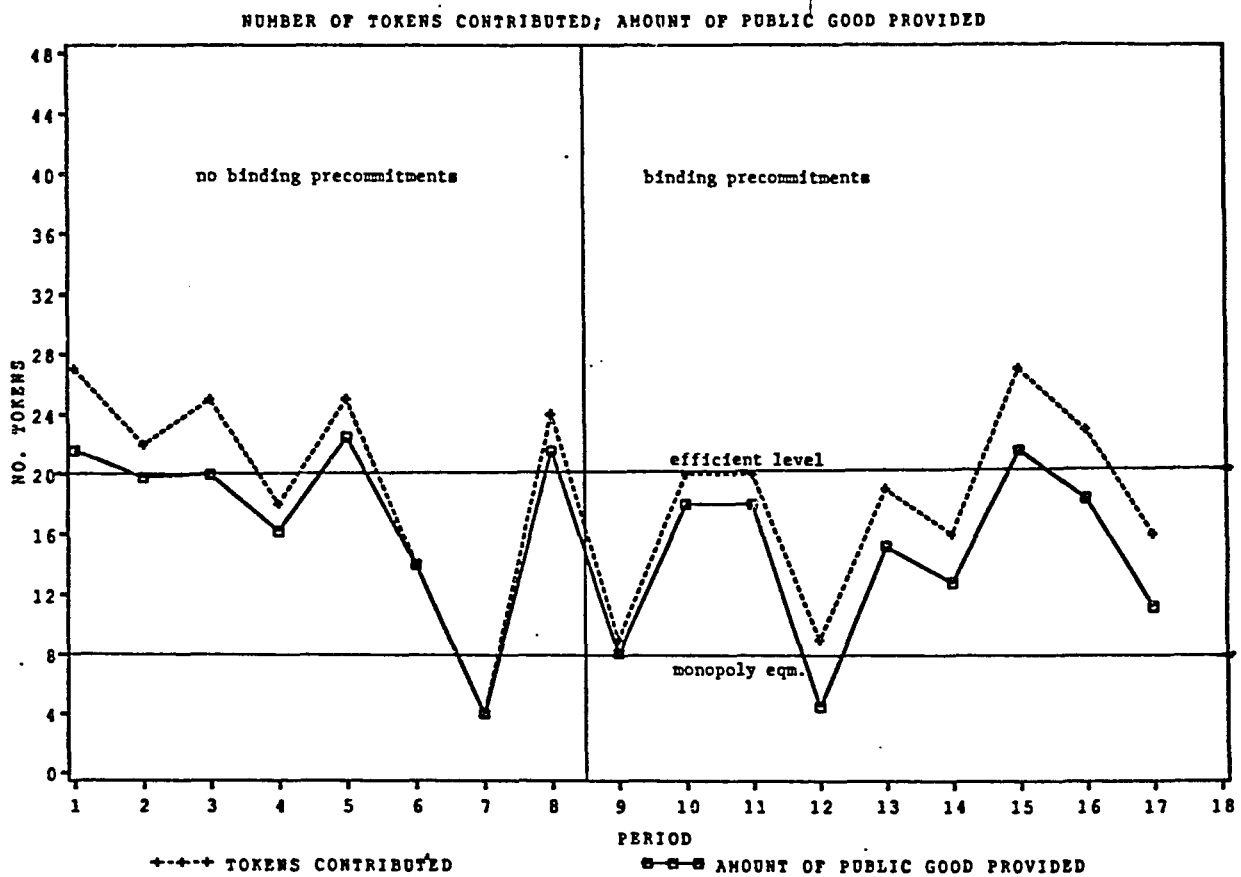


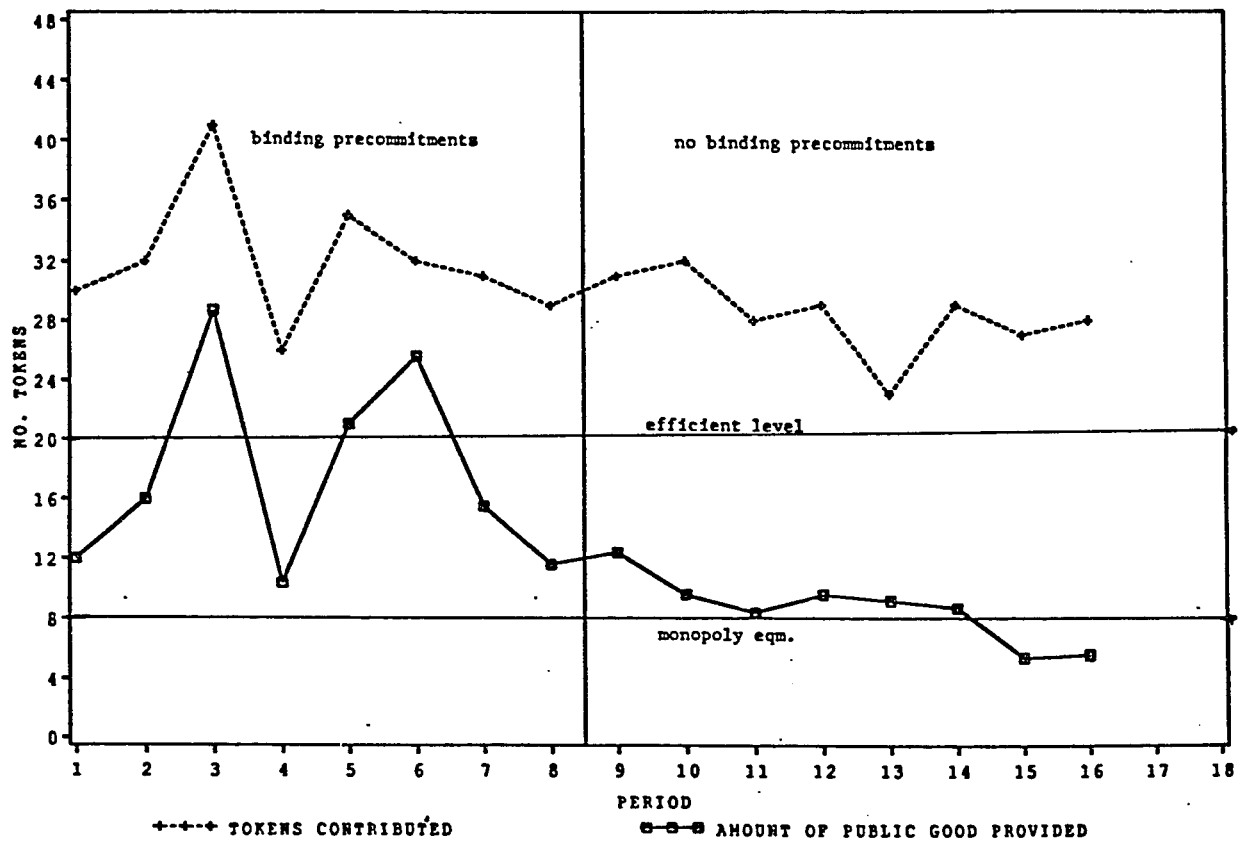
FIGURE 8--NPM2AB



A MATH ERROR IN PERIOD 10 CAUSED TWO EXTRA UNITS OF THE PUBLIC GOOD TO BE PROVIDED

FIGURE 9--NPM3BA

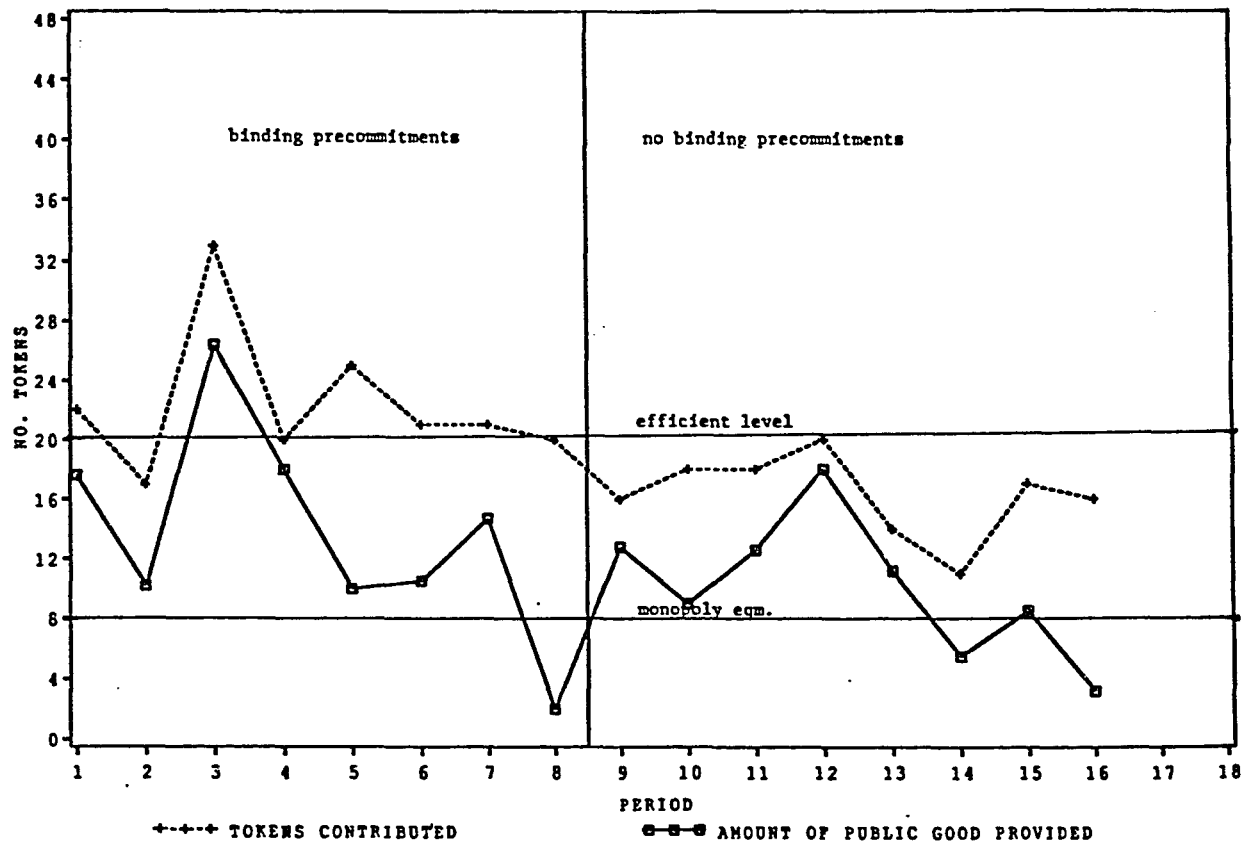
NUMBER OF TOKENS CONTRIBUTED; AMOUNT OF PUBLIC GOOD PROVIDED



A MATH ERROR IN PERIOD 12 CAUSED 3.8 EXTRA UNITS OF THE PUBLIC GOOD TO BE PROVIDED

FIGURE 10--NPM4BA

NUMBER OF TOKENS CONTRIBUTED; AMOUNT OF PUBLIC GOOD PROVIDED



A MATH ERROR IN PERIOD 12 CAUSED 3.8 EXTRA UNITS OF THE PUBLIC GOOD TO BE PROVIDED

sharp swings in the level of the public good. Note that these swings are in both the gross level of donations and the level of the public good.

In the baseline experiments levels are converging toward the Nash equilibrium. In NPC2 and NPC4 contributions seem to be stabilizing between the efficient level and the competitive equilibrium. In NPM3 the amount of the public good provided hovers around the amount predicted for a monopoly, but the level of total contributions and the amount deducted are less than predicted by the monopoly equilibrium.

Observation two. The principal agent problem posed by unconditional donations does not completely hinder the provision of the good.

In no period of any experiment was the level of contributions zero. This is true even in experiment NPM1 where a single seller demonstrated no compunction about taking the entire amount.

Observation three. Donors do not play a grim trigger strategy to discipline sellers.

The best example of this is experiment NPM1AB. Here a monopoly seller deducted the entire amount of donations four

times, yet there were still positive contributions in the following periods.

Observation four. Provision of the good is higher and deductions by sellers are lower in the competitive experiments than in the monopoly experiments.

Observation five. Provision is higher and deductions are lower when nonprofit contracts (binding precommitments) are available.

Observation four is evident from the graphs. Visual evidence for observation five is not as dramatic. Both observations were tested by separately estimating the following equations using the classical pooling method for panel data.(Dielman 1989)

$$PUBGOOD_{it} = \alpha_0 + \alpha_1 PERIOD_{it} + \alpha_2 MONOP_i + \alpha_3 SLMON_i + \alpha_4 NP_{it} + \epsilon_{it}$$

$$PCTDED_{it} = \beta_0 + \beta_1 PERIOD_{it} + \beta_2 MONOP_i + \beta_3 SLMON_{it} + \beta_4 NP_{it} + \eta_{it};$$

where: $PUBGOOD_{it}$=the amount of the public good provided in experiment i in period t;

$PCTDED_{it}$=the total number of tokens passed through by all sellers divided by the total number of tokens contributed;

$PERIOD_{it}$=period t of experiment i;

$MONOP_i$=a dummy variable that equals one if experiment i is a monopoly experiment;

$SLMON_{it}=PERIOD_{it}$ X $MONOP_i$;

NP_{it}=a dummy variable that equal one if sellers have the option of making nonprofit contracts.

It is assumed that the error terms ϵ_{it} and η_{it} have first degree autocorrelation and that their variances differ across cross sections.

The equations were estimated with and without the variable $SLMON_{it}$. The estimated coefficients are given in Table 16. The coefficients for NP_{it} and $MONOP_{it}$ are significant and have signs consistent with observations four and five. Note that the coefficients of $MONOP_{it}$ are larger in absolute value and at a higher significance level than the coefficients of NP_{it}. Evidently, consumers, in this environment at least, benefit more from competition than nonprofit contracts.

Table 16.--Regression Results

Variable	PUBGOOD	PCTDED	PUBGOOD	PCTDED
Intercept	24.53** (10.54)	0.1861* (2.48)	21.23** (12.12)	0.1454* (2.170)
PERIOD	-0.78** (3.56)	.0031 (0.43)	-0.59** (4.48)	.0070 (1.238)
MONOP	-7.43** (2.69)	0.2422* (2.06)	-4.56** (3.54)	0.3087** (5.202)
SLMON	0.24 (0.87)	0.0083 (.693)		
NP	2.65* (2.07)	-0.0717# (1.470)	2.66* (2.23)	-0.0749# (1.615)
Adj. R^2	.8201	.5190	.8278	.4960
N	128	128	128	128

a. Absolute values of t-statistics in parentheses.
b. ** Significant at 1 percent level(two-tailed);
   * Significant at the 5 percent level(two-tailed);
   # Significant at the 10 percent level(one-tailed).

FIGURE 11--Experimental Efficiencies Classified by Binding Precommitments

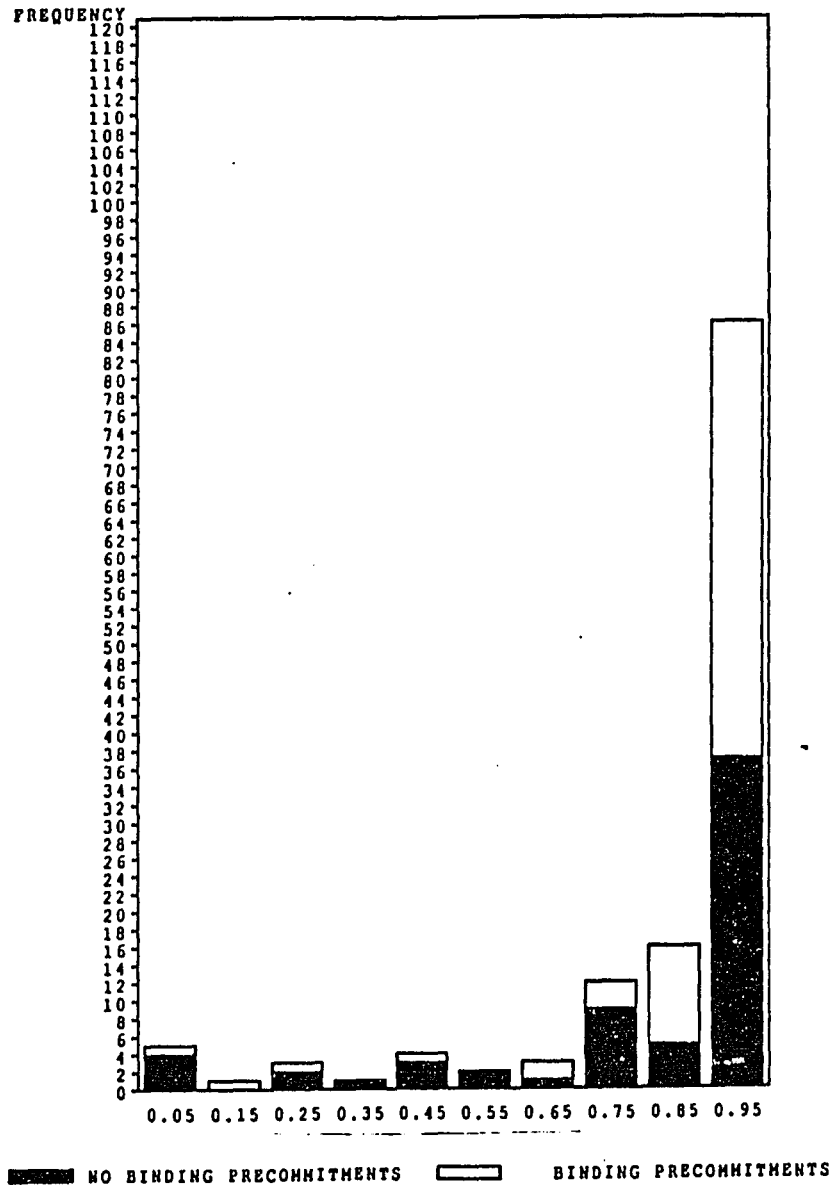
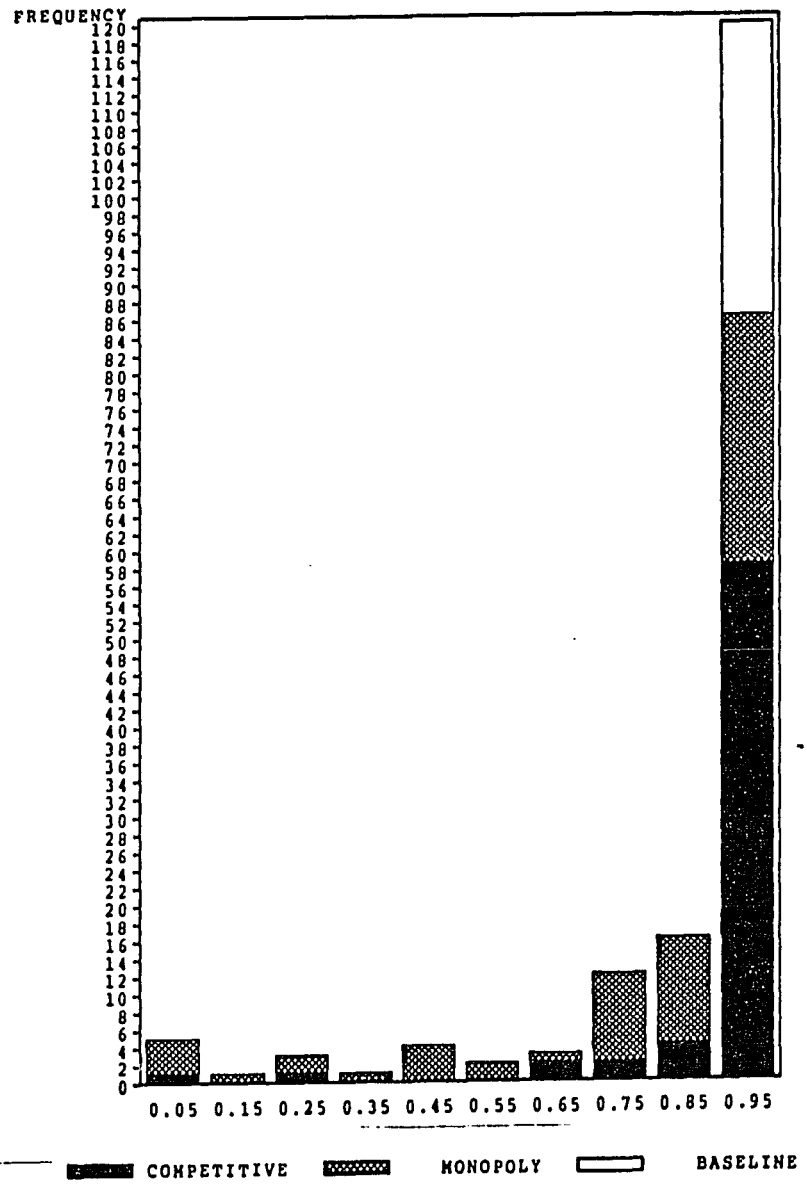


FIGURE 12--Experimental Efficiencies Classified by Number of Sellers



Period efficiencies reinforce observations four and five. I define period efficiency to be:

$$E_t \equiv \frac{\textit{Total realized consumer benefit in period } t}{\textit{Total possible consumer benefit}}.$$

Realized consumer benefit is the total payoff in experimental dollars to all four donors in a period. It is, therefore, the sum of each donor's benefit from the public and private good. Possible consumer benefit is the total possible payoff in experimental dollars to donors in a period. As discussed above, maximum total benefit is realized when 20 units of the public good are provided, 28 tokens are invested in the private good, and no tokens are deducted; for a total of 28,880 experimental dollars. The competitive equilibrium--16 units of the public good, 32 units of the private good, no deductions--pays a total of 28,320 experimental dollars. The difference is due to Nash behavior by donors in the competitive equilibrium that leads to underprovision of the public good.

Figures 10 and 11 show the distribution of period efficiencies. In Figure 10 observations are classified by whether binding precommitments were available in the period. In Figure 11 observations are classified by experiment:

competitive, monopoly, and baseline.

Efficiency in every period of the baseline experiments was above 90 percent, so severe decreases in consumer benefit were caused by seller deductions rather than insufficient donations alone. The graphs demonstrate the benefits to donors from competition and binding precommitments. They also show the benefit from competition is greater than from nonprofit contracts. There were 20 periods when binding precommitments were available where efficiencies fell below 90 percent. There were only 10 periods in competitive markets where efficiencies were below the same threshold.

Finally, the competitive experiments that end with sellers unable to commit (sequence BA) have a noticeable increase in the amount deducted at the end of the experiment. This indicates that nonprofit contracts might have a larger advantage in more uncertain environments.

Individual behavior

Observation six. When they were able to do so, sellers in both the monopoly and competitive situations made binding precommitments a majority of the time.

However, competitive sellers committed more often.

How often sellers made the precommitment is shown in Table 17. The experimental design did not make it necessary for monopolists to make a commitment to maximize their revenue. Monopolists chose to make a commitment most of the time (76 percent of the available opportunities) although less than sellers in a competitive environment (87 percent of the time).

As Table 17 shows donors did give to sellers who did not announce despite the fact that other sellers had announced deductions as low as 0 or 10 percent. Donors who did so usually found themselves burned as the sellers deducted significantly more than what others had announced.

In situations where reputations are necessary for business to get done it is reasonable to expect a donor to give only to a few selected sellers. A donor will stay with a seller who he has found to be trustworthy and a seller, with the prospect of future business, will have an incentive not to misbehave.

It is not necessary that a donor give to the same seller every turn for a trigger strategy to work. All that is

Table 17.--Use of Precommitments

Experiment	Number of Times a Seller Chose Not to Announce
NPC1AB	7(2)/40
NPC2AB	5(3)/40
NPC3BA	5(3)/32
NPC4BA	1(0)/32
NPM1AB	2/8
NPM2AB	3/9
NPM3BA	0/8
NPM4BA	3/8

Note. The second column is read as follows: Total number of times sellers chose not to precommit (number of times a seller who did not precommit was chosen)/total number of opportunities sellers had to precommit.

Table 18.--Donor Loyalty

		Mean	Std. Dev.	t-stat[a] (Prob>|t|)
Binding Precommit.	Allowed	5066.18 n=15	2538.83	.1427 (.8875)
	Not Allowed	5190.83 n=15	2235.15	
Half	First (1-8)	4246.54 n=16	2063.24	2.364 (.0253)
	Second (9-end)	6136.46 n=14	2316.74	

a. The t-statistic tests the null hypotheses that the difference in means of the loyalty indices differs between treatments.

needed is that the donor strike the seller off the list of possible future recipients if the seller misbehaves. Even so, it is to a donor's advantage to give to the same seller every period since uncertainty increases the premium that a seller must receive to stay honest.

As a metric for donor loyalty I use a version of the Herfindahl-Hirschman index. Define L_i to be the loyalty to sellers of donor i by

$$L_i = \sum_{j=1}^{4} s^2{}_{ij};$$

where $s_{ij}=100\cdot(n_{ij}/N_i)$. n_{ij} is the number of times i made a positive donation to seller j, and N_i is the total number of positive donations made by i. Donors had to choose a seller even if they wrote a zero contribution on their donation slip. Since these choices were nonsalient I did not count them.

If a donor gives to all sellers equally his loyalty index is 2500. A loyalty index above 3000 indicates that a donor has a noticeable unequal distribution of choices. A donor with an index above 4000 is choosing a single seller over 50 percent of the time.

Two separate loyalty indices were calculated for each donor in a competitive experiment: one for periods when binding precommitments were allowed and one for periods when they weren't. Extensive free riding by donors in two cases made the indices meaningless so they weren't calculated.

We should expect more donor loyalty when precommitments are not available since reputation and repeated interaction play a more important role. When sellers make binding precommitments a donor can feel free to choose the lowest promised deduction without fear of opportunistic behavior.

> **Observation seven.** On average, donor loyalty to selected sellers is high. Loyalty is unaffected by sellers making binding precommitments. Donors tend to be more loyal in the second half of the experiments.

Table 18 shows the means of the loyalty indices classified by precommitments, allowed or not, and by half of the experiment, periods one through eight or nine to finish. In all cases the mean is above 4000 indicating significant loyalty by the average donor. Donor loyalty was higher when nonprofit contracts were not allowed, but not significantly

so. Donor loyalty was significantly higher during the second half of the experiments.

Two aspects of donor behavior not addressed by the model but worth looking at are the distribution of the burden of financing the public good, and individual donor behavior as an experiment progresses.

To measure the distribution of financing in period t I will again use a version of the Herfindahl-Hirschman index

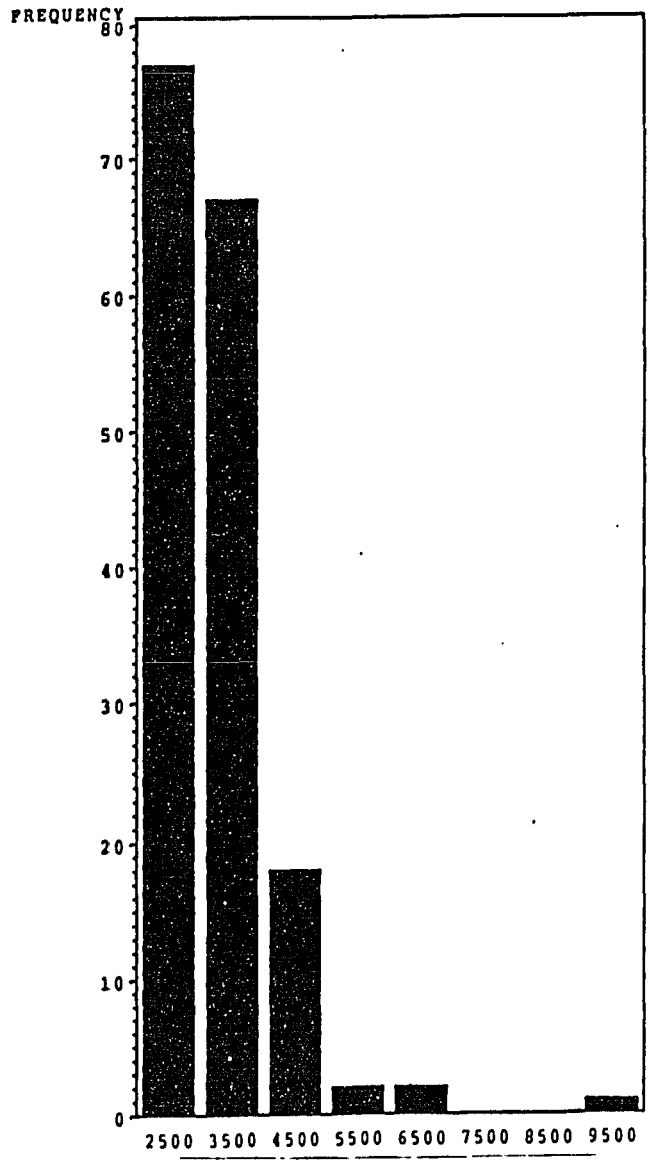
$$B_t = \sum_{j=1}^{4} s^2_{jt}$$

where s_{jt} is 100 times the fraction of gross donations made by donor j in period t. Again the scale ranges from 2500 for an equal burden on all donors to 10,000 for a single donor financing the entire amount. Note that the s_{jt}'s do not measure the share of the actual amount of the public good financed since donors may have chosen different providers.

Observation eight. The burden of financing the public good tends to be inequitable.

Figure 12 shows the distribution of the burden indices B_t calculated for each period of all experiments, including the baselines. The mode of the distribution is at 2500

FIGURE 13--Distribution of Burden of the Public Good



indicating an equal burden. However, a majority of observations are at a level of 3000 and above. A single donor giving zero can kick the index above 3000 and an index in the high 3000's is consistent with a single donor making close to 50 percent of the donations.

Observation nine. Individual contributions decrease moderately over time.

I calculated Pearson correlation coefficients to determine the correlation between the period of an experiment and an individual's contributions. The distribution is shown in Table 19. Contributions for exactly one-half plus one of the forty subjects declined significantly as the experiments progressed. Twelve more subjects had a correlation coefficient that was negative but not significantly so.

The distribution among experimental treatments is worth noting. Contributions for all eight subjects in the baseline experiments declined significantly with time, while the same is true for only a third of the subjects in monopoly experiments. Competitive experiments show a distribution between the two. This supports earlier observations about the relative volatility experiments with endogenous

FIGURE 14--Distribution of Changes in Contributions

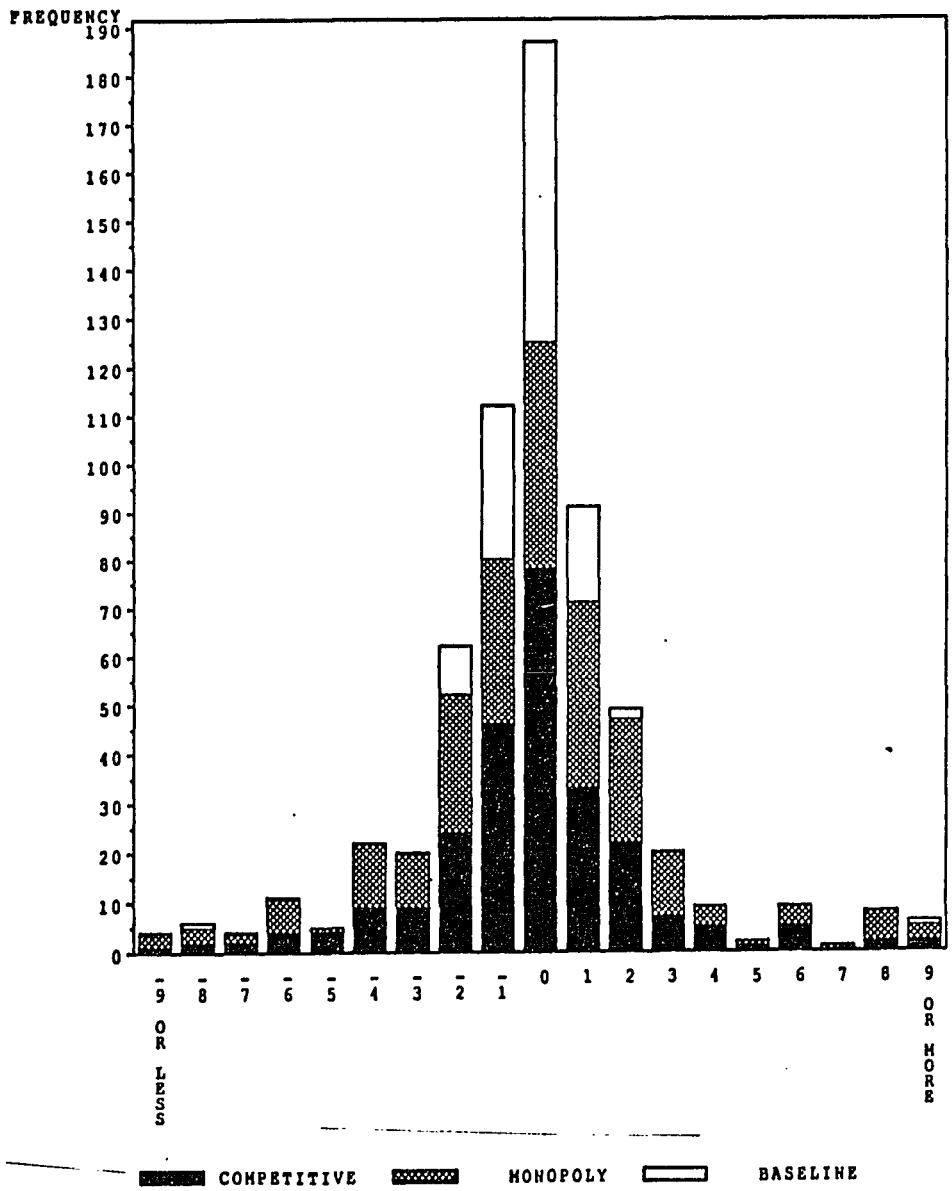


Table 19.--Distribution of Correlation Coefficients between Period and Individual Contributions

	Negative and Significant	Negative but not Significant	Zero	Positive but not Signifi-cant
Baseline	8	0	0	0
Competitive	8	6	1	1
Monopoly	5	6	0	5
Total	21	12	1	6

providers.

Figure 13 shows the distribution of $\Delta m(i)_t = m(i)_t - m(i)_{t-1}$, the change in donor i's contribution from the previous period, over all experiments, classified by half. The modal change in a donor's contribution is zero. Although contributions tended to decline, the magnitude of the change from period to period was relatively small.

Conclusion

This chapter presented laboratory tests of the hypothesis developed by Hansmann(1986) that nonprofit contracts solve the principal-agent dilemma inherent in unconditional, lump-sum donations; and the variation, put forward by Chillemi and Gui, elaborated in Chapter Two, that repeated interaction partially solves the problem.

Observation two shows that strategies stemming from repeated interaction are sufficient to discipline sellers. In no period of any experiment were donations zero. These strategies, however, were not the pure trigger strategies modelled theoretically. Donors did give again to sellers who had withheld the entire amount in a previous period.

Observation five indicates that nonprofit contracts in the form of binding precommitments make donors better off, but Observation four demonstrates that in this environment, at least, competition among sellers benefits consumers much more. End period effects in some experiments hint that there may be environments where the relative magnitude of the effects of competition and nonprofit contracts are reversed. This is an interesting line for future research.

CONCLUSION

This dissertation has shown that it is useful to think about nonprofit organizations as competitive firms in a market. It showed that the existence of a not-for-profit constraint benefits consumers, though in most cases this benefit can only be realized with consumer monitoring and competition among firms. This suggests that dissemination of information to the public and enhancing competition are as necessary as close supervision by the attorney general or the IRS for the provision of certain goods.

This also means that calls for coordination among organizations whether from the United Way or the Ivy League should be treated with the same amount of skepticism as if they had come from the Big Three auto makers. As the model explained in Chapter Two, although a cartel reaches more of the population, freeing managers from competition allows them to divert more contributions toward their personal benefit. The net effect on the total amount of the good provided is unclear. To benefit donors, a cartel has to be closely monitored either by donors or the government.

Empirical tests reported here supported these

conclusions. Chapter Three found a significant relation between the number of organizations in a market and the fraction of donations used for services. Chapter Four also found this relation, and in addition, demonstrated that nonprofit contracts are not needed to ensure that managers won't misbehave.

These two chapters also hint at fruitful lines of future research. First, the data used in Chapter Three suggest significant intertemporal allocation of funds, an aspect not addressed in the simple model presented here. A dynamic, multiperiod model of nonprofit organizations would be a useful extension.

Another gap is empirical knowledge of giving behavior. Little is known about how donors distribute contributions sectorally and geographically. Consequently tests like Chapter Three's require formidable assumptions about the definition of a market. Further work in this area requires that this gap be filled.

In the experimental tests, competition was a greater disciplining mechanism than nonprofit contracts. However, there were hints that in an uncertain environment the

relative magnitude of the effects might be reversed. More experiments to test this proposition would be interesting.

The above discussion shows that even though the stream of research on nonprofit organizations has swollen to a flood in the past decade, there are significant questions that still need to be answered. This work and others have made a small step in applying principal-agent theory to nonprofit organizations. Much work has been done on how the government should regulate an electric company or buy jet aircraft, but little has been done on how it should finance research or subsidize mental health care. Given recent policy initiatives, these are questions that are pertinent as well as interesting.

APPENDIX A--PAYOFF SHEET FOR DONORS

X--Your payoff is 100 experimental dollars for each unit of commodity X you buy.

Y--Consult the following chart to determine your payoff for commodity Y.

Q=Total amount of commodity Y purchased by **all** buyers.
P=Payoff to you in experimental dollars.

Q	P	Q	P
0	**0**	**12**	**5750**
0.1	59	12.1	5766
0.2	118	12.2	5782
0.3	177	12.3	5798
0.4	236	12.4	5814
0.5	295	12.5	5830
0.6	354	12.6	5846
0.7	413	12.7	5862
0.8	472	12.8	5878
0.9	531	12.9	5894
1	**590**	**13**	**5910**
1.1	648	13.1	5924
1.2	706	13.2	5938
1.3	764	13.3	5952
1.4	822	13.4	5966
1.5	880	13.5	5980
1.6	938	13.6	5994
1.7	996	13.7	6008
1.8	1054	13.8	6022
1.9	1112	13.9	6036
2	**1170**	**14**	**6050**
2.1	1227	14.1	6062
2.2	1284	14.2	6074
2.3	1341	14.3	6086
2.4	1398	14.4	6098
2.5	1455	14.5	6110
2.6	1512	14.6	6122
2.7	1569	14.7	6134

2.8	1626	14.8	6146
2.9	1683	14.9	6158
3	**1740**	**15**	**6170**
3.1	1796	15.1	6181
3.2	1852	15.2	6192
3.3	1908	15.3	6203
3.4	1964	15.4	6214
3.5	2020	15.5	6225
3.6	2076	15.6	6236
3.7	2132	15.7	6247
3.8	2188	15.8	6258
3.9	2244	15.9	6269
4	**2300**	**16**	**6280**
4.1	2355	16.1	6289
4.2	2410	16.2	6298
4.3	2465	16.3	6307
4.4	2520	16.4	6316
4.5	2575	16.5	6325
4.6	2630	16.6	6334
4.7	2685	16.7	6343
4.8	2740	16.8	6352
4.9	2795	16.9	6361
5	**2850**	**17**	**6370**
5.1	2904	17.1	6377
5.2	2958	17.2	6384
5.3	3012	17.3	6391
5.4	3066	17.4	6398
5.5	3120	17.5	6405
5.6	3174	17.6	6412
5.7	3228	17.7	6419
5.8	3282	17.8	6426
5.9	3336	17.9	6433
6	**3390**	**18**	**6440**
6.1	3443	18.1	6445
6.2	3496	18.2	6450
6.3	3549	18.3	6455
6.4	3602	18.4	6460
6.5	3655	18.5	6465

6.6	3708	18.6	6470
6.7	3761	18.7	6475
6.8	3814	18.8	6480
6.9	3867	18.9	6485
7	**3920**	**19**	**6490**
7.1	3972	19.1	6493
7.2	4024	19.2	6496
7.3	4076	19.3	6499
7.4	4128	19.4	6502
7.5	4180	19.5	6505
7.6	4232	19.6	6508
7.7	4284	19.7	6511
7.8	4336	19.8	6514
7.9	4388	19.9	6517
8	**4440**	**20**	**6520**
8.1	4488	20.1	6522
8.2	4536	20.2	6524
8.3	4584	20.3	6526
8.4	4632	20.4	6528
8.5	4680	20.5	6530
8.6	4728	20.6	6532
8.7	4776	20.7	6534
8.8	4824	20.8	6536
8.9	4872	20.9	6538
9	**4920**	**21**	**6540**
9.1	4958	21.1	6541
9.2	4996	21.2	6542
9.3	5034	21.3	6543
9.4	5072	21.4	6544
9.5	5110	21.5	6545
9.6	5148	21.6	6546
9.7	5186	21.7	6547
9.8	5224	21.8	6548
9.9	5262	21.9	6549
10	**5300**	**22**	**6550**
10.1	5328	22.1	6549
10.2	5356	22.2	6548
10.3	5384	22.3	6547

10.4	5412	22.4	6546
10.5	5440	22.5	6545
10.6	5468	22.6	6544
10.7	5496	22.7	6543
10.8	5524	22.8	6542
10.9	5552	22.9	6541
11	**5580**	**23**	**6540**
11.1	5597	23.1	6538
11.2	5614	23.2	6536
11.3	5631	23.3	6534
11.4	5648	23.4	6532
11.5	5665	23.5	6530
11.6	5682	23.6	6528
11.7	5699	23.7	6526
11.8	5716	23.8	6524
11.9	5733	23.9	6522
		24	**6520**

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