

Using Experiments to Investigate Shared Capitalism and Productivity:
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(Work in progress—please do not cite!)

Introduction

Over the past 35 years, a theoretical literature has developed that investigates how employee ownership affects employee motivation (e.g. Vanek, (1977); Ellerman, (1982); Ben-Ner, (1995)). The next step is, of course, to test the propositions generated by the theory. It has, however, proven extremely difficult to do so using traditional data because many unobservable firm characteristics including the level of social capital in the firm, the precise production and monitoring norms and practices, the ability of the worker, and other firm idiosyncrasies confounding the identification of the effects of structural characteristics on motivation.¹

To this end, I am using my Rutgers Research Fellowship to collect a novel data set in a controlled setting in an effort to mitigate many of these confounding issues to directly test how employee ownership of assets affects the motivation of workers. Before describing this specific research, my expectations, and my (very early, and very limited) findings, I first provide some context to how this specific issue relates to a broader research program I am engaged in that uses the experimental method to inform the study of personnel and the economics of the organization.

¹ A growing empirical literature suggests that on average, employee ownership is associated with a weak-positive effect on firm performance when compared to conventional firms (e.g. Kruse, (1993), Freeman and Dube, (2000), Blasi, Kruse, and Bernstein, (2003)).

Background

In the construction of the theoretical framework evaluating the effect of employee ownership and participation on productivity, Ben-Ner and Jones (1995) provide a 2-dimensional typology that illustrates different stylized combinations control and ownership arrangements that can be held as bundles by workers (summarized in Table 1 below).

Table 1: Typology of Employee Ownership According to Control and Return Rights

<i>Return Rights Held by Employees</i>	<i>Control Rights Held by Employees</i>			
	None	Participation	Sharing	Majority Control
None	Conventional Firms	Quality Circles	Employee Reps on B.O.D	Common Ownership (Scott Bader)
Small	Prof Sharing: ESOP (Occidental Petro)	Prof Sharing w/ Participation	Co-Determination	British Retail Coop
Moderate	ESOPs (Proctor & Gamble)	Scanlon Plans (Lincoln Electronics)	Producer Coop (U.K Clothing)	Producer Coop
Majority	ESOPs (Vermont Asbestos)	ESOPs (Brooks Camera)	ESOPs (Weirton Steel)	Producer Coop (U.S. Plywood)

Notes: Reproduced and summarized from Table 1 in Ben-Ner and Jones (1995), pp 534.

Clearly, the full spectrum of control and ownership arrangements cannot be classified in a simple, 4 x 4 table. Such abstractions, however, are necessary to accommodate theoretical analysis. The same is also true in experimental design. The practice of essentializing firm aspects in this manner raises valid concerns regarding the generalizability of a particular set of findings. Provided findings from an experiment are systematic and replicable within a well-defined set of institutions, experimental economists (like theorists) inductively reason that similar 'real-world' institutions *might* give rise to similar behavior.

Despite being a relatively recent innovation used in the study of Economic Organizations and Personnel, the experimental method has shone a bright light

on several issues that challenge the way economists have thought about human behavior under various incentives and firm circumstances. Several of these insights correspond directly to issues commonly discussed in the Shared Capitalism literature.

For example, most researchers of organizational behavior consider the effect of return rights on individual motivation to be positive (e.g. Schuster, (1987); Kruse, (1993)). The argument is that the greater the collective share of employees in the returns of the firm in which they work, the greater the dependence of their individual well-being on the firm's well-being, and therefore the greater is their commitment to the firm and their identification with its goals. While this intuition is straightforward, it is based upon a set of behavioral assumptions that paradoxically lead to doubts about this very argument centered around the '1/n' or free-riding problem. Specifically, if all employees were both rational and motivated solely to pursue their private material gain, free-riding behavior could be observed.² An immense body of research has shown, however, that the free-rider problem can rather easily be mitigated, if not 'managed' rather easily.

² Several theoretical solutions exist within the rational actor model showing the possibility of sustained cooperation including the Kreps and Wilson (1982) 'reputation effect' model shows that incomplete information regarding the preferences of other players (egoist or altruist) is sufficient for an egoist player to play a cooperative strategy because of the unverifiable belief that the population may have at least some actors willing to play a cooperative strategy. A folk theorem in noncooperative game theory gives plausible stories of how group incentive schemes can overcome free-riding in repeated interactions when the discount rate of agents is sufficiently small so that future outcomes are valued similarly to present outcomes (Fudenberg and Maskin, (1986)). Under these conditions, cooperation can be rationally preferred and sustained through time by egoists in infinitely repeated games when all, or some fraction of agents (depending on the parameters defined by theory) share the exogenous traits for specific, and credible 'tit-for-tat' or 'grim reaper' strategies.

For example, experiments in economics have quite clearly shown that free-rider problems *do not* tend to arise when the affected parties have

(1) Sufficient levels of other-regarding preferences (e.g. Fehr and Schmidt (1999); Pech (2009); Bolton and Ockenfels (2000); Charness and Rabin (2002)),

(2) Subjects can communicate (e.g. Ledyard (1995); Sally (1995); Cooper et al. (1992); Croson et al. (2003); Suetens (2005); Duffy and Feltovich (2002); Frohlich and Oppenheimer (1998))

(3) A fraction of subjects display a willingness to enforce cooperation at a monetary and/or social cost (Anderson and Stafford (2003); Dickinson (2001); Andreoni et al. (2003); Carpenter and Seki (2005))

(4) Subject have developed some type (even very superficial) group identity (Eckel and Grossman (2005); Cox et al. (1991); Charness and Jackson (2007); McLeish and Oxoby (2007))

Furthermore, field studies conducted by Ostrom (1999) and her co-authors identify at least 27 different unique local rules used to enforce mutual cooperation in the management of a common property resource. It is not a stretch to therefore imagine analogous cultural aspects at play when managing the provision of effort within firms. The sharp conclusions reached in the above mentioned studies add credence to the plausibility that under 'normal' circumstances, free-riding should not be expected to be a large issue in firms that

use group-based rewards. Indeed, these findings complement Weizman and Kruse's (1990) meta-analysis of naturally occurring data, which suggests a weak-positive correlation between profit-sharing and productivity, quite nicely.

Some other notable examples of the lab revealing systematic deviations from typical personnel models rooted in the rational actor model include (1) the common finding that there is a wide variance in effort under rank-order compensations schemes (e.g. Bull et al. (1987); van Dijk et al. (2001); Shearer (2004))

(2) the strong tendency for workers to reciprocate 'gift-wages' with higher effort (e.g. Fehr et al. (1998); Fehr et al. (1993); Gächter and Falk (2001); Charness and Haruvy (2002); Maximiano et al. (2007))

(3) the relationship between extrinsic incentives and motivation ala 'pay-for-performance' is hardly as straightforward as the standard economics dictum that "people respond to incentives" with scores of papers showing how incentive compatible payments can lead to lower performance (e.g. Gneezy and Rustichini (2000); Titmuss, (1971); Fehr, et al. (1998)).³

Present Research

In short, the aim of my research is to use the lab to help isolate the independent, and complementary motivational effects of employee control in

³ Many theories from social psychology (e.g. Deci (1971); Deci, and Ryan (1985); Deci and Ryan (2000) and also from economics (e.g. Frey and Jegen (1999), Frey and Jegen (2001), Rob and Zemsky (2001), Huck, Kübler, and Weibull (2003)), and Bowles and Huang (2008)) have all been developed in to capture these empirical regularities.

decision-making (participation) and asset ownership by analyzing the same basic dimensions laid out in Table 2. As a first pass, I've selected four *very* general institutional arrangements to study in the lab shown in Table 2 below:

Table 2: Baseline Latin Square

	High Participation	Low Participation
High Residual Share	1	2
Low Residual Share	3	4

To a large extent, this research project is already underway. In a recent working paper Mellizo, Carpenter, and Matthews, (2011) compare changes in the performance of our participants when the compensation scheme is implemented either endogenously by the workers using a simple majority vote or by a random process completely exogenous to the group (comparing cells 1 and 2).⁴ Using a 2 (decision-control rights regimes) by 2 (incentive contracts) between-subjects design, we compare performance under different decision-control rights treatments and report evidence showing that effort is sensitive to the decision-control rights arrangement used to select the compensation contract. Groups of workers able to participate in determining their own compensation scheme increased effort significantly relative to groups that had this decision implemented by an exogenous process. Further, these effects persist even after controlling for gender, compensation scheme, and ability.

⁴A draft of this paper can be found at http://www.iza.org/index.html?lang=en&mainframe=http%3A//www.iza.org/en/webcontent/publications/papers/viewAbstract%3Fdp_id%3D5460&. By design, we control for all issues that pertain to monitoring, punishment, threats, or other forms of coercion that might also accompany many types of systems of control in real-world firms. We further strip down the effort task so that it is not reliant on team production to minimize confounds that could arise in social dilemmas (e.g., trust, reciprocity or reputation) and restrict the menu of potential compensation schemes, to two where all claims on residual profits are held by labor. Our real-effort task additionally allows us to collect measures of both effort (trying hard) and effective effort (quality of work).

Similarly, a companion project sponsored by the Rutgers Research Fellowship Program aimed to investigate the saliency of financial incentives akin to those in cells 2 and 3 is underway. A brief sketch of this protocol follows.

Protocol Summary and Design:

The following experiment compares 3 basic treatments; a Control where subjects are paid a flat-wage of \$1.50 for each 5-minute work period (the work period is described below); Treatment 1 where subjects are paid a flat-wage and are each allocated x out of y total equity shares (where $y = 9x$); Treatment 2 where subjects are paid a flat-wage and are each allocated x out of y total equity shares (where $y = x$).

Group size:

Upon entering the lab, subjects will be issued a number, given a set of the experiment instructions, and seated. In the instructions (which will also be read aloud to the subject by the lab assistant), subjects will learn that they have been randomly assigned to a group of 3. They will also learn that all three of these workers belong to the same 'firm' and all three subjects will engage in the same work task (to be described below).

Work period:

Following the growing trend in labor market and personnel economics experiments, we intend to collect data from a real-effort experiment by extending a protocol used both in Niederle and Vesterlund (2008) and Mellizo (2010) wherein subjects are asked to solve simple addition problems over a 5-minute

work period. This task allows us to collect measures of both effort (trying hard) and effective effort (quality of work). This task is desirable since the previous studies that have used this to measure effort of subjects have found it not to be biased along any identifiable dimension (i.e. age, gender, major).

Subject earnings:

From the experiment instructions each subject knows that for each 5-minute period of work (solving simple addition problems) they will be paid a flat-wage equivalent to \$1.50 for each 5-minute period. This is common for all treatments. In the control treatment, this payment for their effort is the only source of their earnings (aside from the show-up fee). In Treatment 1 and Treatment 2, subjects know that that they will be paid a flat-wage in addition to the value of the firm stock that they hold. The difference between Treatment 1 and Treatment 2 is in the number of stock shares that each subject holds relative to the total number of firm shares. In Treatment 1 each of the 3 subjects in each group is allocated 1 equity share out of a total of 9 firm shares, and in Treatment 2, each of the 3 subjects in each group is allocated 3 equity shares out of a total of 9 firm shares.

Asset price determination:

In publically traded ESOPs the value of the share is partially reflective of the of the productivity of its work force, but it is also a function of the various factors that fall outside of the control of the workforce including the investment decisions of its shareholders, the health of its CEO, the presence of market speculators, exogenous forces that influence the demand for the firm's services

and so on. The value of the company stock is therefore a function of both the combined effort its workforce and a vector of uncertainty (a similar argument could be made for a profit-sharing arrangement). In this experimental protocol the value of the firm's stock is the sum of the output provided by all three subjects measured by the number of correct answers provided in their work task multiplied by a random factor r that falls between 0.10 and 2.00. The product is then divided by the total number of shares (9) to determine the value of each share.

Step-by-step experiment sequence

- Subjects are assigned a number and given a copy of the instructions.
- Instructions are read aloud to subjects explaining the effort task and how they will be compensated for their effort during the experiment. Their compensation depends on the treatment that they are participating in. - Standard randomization to treatment procedures are used (picking a number out of a hat) that informs me (the experimenter) which treatment will be conducted for a given session. I employ a between-subject design so each subject that participates only participates in one treatment.
- Subjects are not told that other treatments exist.

Control treatment

- Subjects are randomly put into groups of 3
- Subjects have a 3-minute practice period where they are given a series of simple addition to familiarize themselves with the effort task
- Subjects are reminded that they will be compensated via a flat-wage of

\$1.50 for a 5-minute period of solving simple math problems.

-Subjects then 'work' for a 5-minute period

-Subjects then learn how many questions they attempted how many questions they answered correctly and are reminded of their earnings for their work during the 5 minute period (a flat-wage of \$1.50)

-A total of 5 periods are planned, but this information is not announced in the experimental instructions so as to avoid 'final period' effects.

-At the end of the 5th period, all subjects are called in turn by their last name to collect their earnings

Treatment 1

-Subjects are randomly put into groups of 3

-Each subject is allocated *a single equity share* of a firm with 9 total equity shares

-Subjects go through a 3-minute practice period where they are given a series of simple addition to familiarize themselves with the effort task

-Subjects are reminded on their screen that they will be compensated via a flat-wage equivalent to \$1.50 for a 5-minute period of solving simple math problems. They are further reminded that they have one share out of 9 total shares and the value of this share is the sum total of correct answers from all three workers multiplied by a random number ranging from 0.10 to 2.0 and then divided by the total number of shares (9).

-Subjects then 'work' for a 5-minute period

-At the end of the period, subjects are shown how many questions they attempted, how many questions they answered correctly and their earnings for their work during the 5 minute period (a flat-wage of \$1.50)

the value of their asset which is returned to them that period

-Subjects are informed that they will have another work period sequence identical to the first work period.

-Again, a total of 5 periods are planned, but this information is not announced in the experimental instructions so as to avoid 'final period' effects. At the end of the 5th period, all subjects are called in turn by their last name to collect their earnings

Treatment 2

-Subjects are randomly put into groups of 3

-Each subject is allocated 3 *equity shares* of a firm with 9 total equity shares

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(Same as Treatment 1)

Expectations/Predictions:

My expectations for the above study are open. A simple "straw-man" principal-agent model would predict zero differences in labor supply between the three different contracts. These predictions of course assume rationality, and are absent social preferences.

From a Behavioral Economic perspective, we would not be surprised if a worker with a small ownership share were to "irrationally" confuse their ability to affect the value of the share by offering a high level of effort when their contribution cannot be teased out from the firm value. A dominant theme in

social psychology is the notion that individuals often create patterns (in this case by providing higher effort) in an attempt to give structure to unpredictable situations (e.g. Glass and Singer (1972); Whitson and Galinsky, (2008)).

Pilot results

A small set of subjects (Total $n = 18$, Treatment 1 $n = 9$ and Treatment 2 $n = 9$) participated in an abbreviated pilot study (2 round) conducted at The College of Wooster in later in the Fall 2010 term. While the number of observations is far too limited to draw any (weak) conclusions, there are no differences between effort offered in Treatment 1 and Treatment 2 (Mann-Whitney $\text{Prob} > |z| = 0.421$).

Looking Forward

The first live run of data collection is scheduled for March 9th.

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Appendix

Experiment Instructions (Common to all Treatments)

Thank you for participating in our study today. You will earn \$7.50 just for showing up on time and during the experiment, you will have the opportunity to earn more money. At the conclusion of the experiment, the payments that you have accumulated will be paid to you in cash. This research is sponsored by the Federation for Enterprise Development Beyster Fellowship Program.

Please note that any and all actions and decisions that you make in the exercises or responses you provide are strictly confidential and anonymous. We intend to use the data collected from our study for academic work as it relates to firm organization and industrial relations.

A lab assistant will read all subsequent instructions aloud to you. Please read along with the lab assistant as s/he read them to you. If you have any questions while these instructions are being read, please raise your hand and we will attempt to answer them. *You are not allowed to communicate with other participants during the experiment, even to clarify instructions.* Again, if you have any questions, please raise your hand and a lab assistant will assist you. At the end of the experiment session, we will call you individually by your ID number distributed to you to give you your earnings in cash.

(Instructions unique to the Flat-Wage Treatment)

Instructions: Part 1

In this experiment you will be completing a production task that consists of adding up sets of 2-digit numbers. The use of a calculator is prohibited, but you may use scratch paper and pencil provided to you on your desk. The numbers that you will be adding together are randomly drawn and each problem is presented in the following way:

EXAMPLE: SCREEN SHOT

After you submit an answer *on the computer*, you will be given a new problem to solve. The production task of solving addition problems in each Period 1 will last for 5 minutes. At the end of 5 minutes you will be presented with a summary of how many problems you correctly solved as well as your payment for the period.

Your compensation for solving problems in each Period will be a fixed payment of = \$1.50.

Experiment Instructions (Flat-wage + Public ESOP)

Part 1 of Experiment Instructions

You have been randomly put into a group with 2 other people (3 total). You are connected through the computer network in this room and your respective identities will remain anonymous throughout the duration of Period 2.

In this experiment you will be completing a production task that consists of adding up sets of 2-digit numbers. The use of a calculator is prohibited, but you may use scratch paper and pencil provided to you on your desk. The numbers that you will be adding together are randomly drawn and each problem is presented in the following way:

SCREEN SHOT

After you submit an answer on the computer, you will be given a new problem to solve. The production task of solving addition problems in each period will last for 5 minutes. At the end of 5 minutes you will be presented with a summary of how many problems you correctly solved as well as your payment in the Period.

Part 2 of Instructions-- Compensation

In addition to being compensated a fixed-wage of \$1.50 for the 3 minute period, your compensation is also a function of the value of an *ownership share*.

What is an ownership share?

All three individuals in your group are have been allocated ONE ownership share of the “firm” that you belong to. In this experiment, there are 9 total ownership shares in the firm. Because each individual in your group has the same number of shares (1), and there are 9 total shares, all of the employees in your firm own

$(1+1+1)/9 = 1/3^{\text{rd}}$ of the total shares in the firm.

Determination of the value of a share

The value of each share is a function of both the performance of the workers in the firm and a number of factors that fall outside of the direct control of workers (i.e. the investment decisions of other shareholders, the traders that are speculating on the performance of the firm, changes in external market conditions etc). That is, there is a fair amount of uncertainty that must be factored into the valuation of a given share.

The value of the share in our experiment is calculated by following the 3-step process:

- 1) The number of correct answers from all 3 individuals in the group are summed together
- 2) The total from (1) is multiplied by a randomly determined number between .10 and 2.0.
- 3) The value from (2) is divided by the number of total shares in the firm (9).

For example: Let us assume that Subject 1 solves 4 addition problems correctly, Subject 2 solves 9 correctly, and Subject 3 solves 14 correctly. Let us further assume that the randomly determined number between 0.1 and 2.0 was = 1.94

Step 1 of 3:

Subject 1: 4 correct answers

Subject 2: 9 correct answers

Subject 3: 14 correct answers

$4 + 9 + 14 = 27$ total correct answers

Step 2 of 3:

$27 * (1.94) = 52.30 = \text{Total Group Value}$

Step 3 of 3:

$52.30 / 9 \text{ shares} = 5.811$

5.811 = Share value

Therefore, the payoff for all subjects in the Period is

= \$1.50 (fixed wage) + \$5.811 (share value)

= \$7.311

In subsequent Periods, you will again be presented with the same production task that consists of adding up sets of five 2-digit numbers. The use of a calculator is prohibited, but may use scratch paper and pencil provided to you on your desk. After you submit an answer on the computer, you will be given a new problem to solve. The production task of solving addition problems in all subsequent Periods will last for 5 minutes.

Experiment Instructions (Flat-wage + Full Residual Claim ESOP)

Part 1 of Experiment Instructions

You have been randomly put into a group with 2 other people (3 total). You are connected through the computer network in this room and your respective identities will remain anonymous throughout the duration of Period 2.

In this experiment you will be completing a production task that consists of adding up sets of 2-digit numbers. The use of a calculator is prohibited, but you may use scratch paper and pencil provided to you on your desk. The numbers that you will be adding together are randomly drawn and each problem is presented in the following way:

SCREEN SHOT

After you submit an answer on the computer, you will be given a new problem to solve. The production task of solving addition problems in the period will last for 5 minutes. At the end of 5 minutes you will be presented with a summary of how many problems you correctly solved as well as your payment in the period.

Part 2 of Instructions-- Compensation

In addition to being compensated a fixed-wage of \$1.50 for the 3-minute period, your compensation is also a function of the value of an *ownership share*.

What is an ownership share?

All three individuals in your group are have been allocated 3 ownership shares of the “firm” that you belong to. In this experiment, there are 9 total ownership

shares in the firm. Because each individual in your group has the same number of shares (3), and there are 9 total shares, all of the employees in your firm own $(3+3+3)/9 = 100\%$ of the total shares in the firm.

Determination of the value of a share

The value of each share is a function of both the performance of the workers in the firm and a number of factors that fall outside of the direct control of workers (i.e. the investment decisions of other shareholders, the traders that are speculating on the performance of the firm, changes in external market conditions etc). That is, there is a fair amount of uncertainty that must be factored into the valuation of a given share.

The value of the share in our experiment is calculated by following the 3-step process:

- 1) The number of correct answers from all 9 individuals in the group are summed together
- 2) The total from (1) is multiplied by a randomly determined number between 0.10 and 2.0.
- 3) The value from (2) is divided by the number of total shares in the firm (9).

For example: Let us assume that Subject 1 solves 4 addition problems correctly, Subject 2 solves 9 correctly, and Subject 3 solves 14 correctly. Let us further assume that the randomly determined number between 0.1 and 2.0 = 1.94

Step 1 of 3:

Subject 1: 4 correct answers

Subject 2: 9 correct answers

Subject 3: 14 correct answers

$4 + 9 + 14 = 27$ total correct answers

Step 2 of 3:

$27 * (1.94) = 52.30 = \text{Total Group Value}$

Step 3 of 3:

$52.30 / 9 \text{ shares} = 5.811$

5.811 = Share value

Therefore, the payoff for all subjects in the Period is

= \$1.50 (fixed wage) + (\$5.811 share value) (3 shares)

= \$18.93