

WAGES, EMPLOYMENT, AND CAPITAL IN CAPITALIST
AND WORKER-OWNED FIRMS

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ABSTRACT

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Differences in wages, employment, and capital between worker-owned and capitalist enterprises are computed from a matched employer-worker panel data set from Italy, the market economy with the greatest incidence of worker-owned and worker-managed firms. These observed differences are related to basic models of the behavior of the capitalist firm and worker co-op. The estimates of the wage, employment, and capital equations largely corroborate the implications of the behavioral models of the two types of enterprise. Wages are about 14 percent lower on average and they tend to be more volatile (and employment less volatile) in co-ops compared with capitalist enterprises. Previous research has relied on case studies to investigate these issues and has not drawn upon such large and extensive data sets on workers and firms as exploited in this paper. In this sense, our results can claim to constitute general findings about capitalist and co-op enterprises.

JEL Classification: J54, D21, L21.

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I. Introduction

The goal of this paper is to examine differences in the responses of two types of firms and to assess whether these firms' reactions to changes in their environment conform to textbook models of their behavior. One type of firm is the familiar proprietorship or corporation in which those who supply the firm's capital manage the company (or select the managers) and enjoy the residual returns. Such capital-owned and capital-managed firms are, of course, the dominant form of economic organization in the private sector of market economies and the prevalence of this organizational form provides the rationale for such economies being called capitalist. Workers are hired - often indirectly - by those who provide the firm's capital.

A second type of firm is that owned and managed by its workers. We label such a worker-owned and worker-managed firm a worker cooperative. In a worker co-op, capital is borrowed from financial intermediaries or provided by the workers who act as holders of the equity. Ultimate managerial decisions in a co-op rest with the worker-owners.

Worker co-ops exist in all market economies in different degrees, but they are far less common than capital-owned firms. Indeed, a question of long-standing is what accounts for the relative rarity of worker co-ops.¹ One explanation is that the incentives contained in worker co-ops are not conducive to their survival. For instance, it is sometimes asserted that, when net revenues are distributed among a large class of workers as in most co-ops, work incentives are dulled and workers become shirkers. Another claim is that co-ops respond to an increase in output prices not by expanding production and

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¹ See Dow (2003), Dow and Putterman (1999), Hansmann (1996), and Pencavel (2001) for recent attempts to answer this question.

moving resources into activities that consumers deem more valuable but the reverse, that is, co-ops tend to curtail output in response to a product price increase.² This “perverse” behavior discourages the expansion of worker co-ops. Indeed, by replacing departing worker-members with hired employees, it has been asserted that co-ops have a tendency to “degenerate” into capitalist firms over time.³

At the same time, when capitalist enterprises cut employment by ceasing their operations or moving abroad, popular writings speculate that, if these firms’ employees possessed greater voice, these job losses would be less frequent or extensive and other ways to respond to market shocks would be sought. Indeed, many countries have recognized these issues either by requiring firms to secure the approval of state agencies or to consult with the representatives of employees before making extensive layoffs. This raises the question of whether firms operate differently when workers have a greater voice over the activities of enterprises. Whereas unionized workers in a capitalist firm must bargain with the firm’s owners (or the representatives of the firm’s owners) to achieve certain goals, the worker-owned and worker-managed firm does not require such a step and thus, in co-ops, observed outcomes do not reflect the mixed objectives of workers and management. It is important to determine whether firms where workers have such ultimate voice operate differently from firms where this voice is muted.

These issues have been addressed in a number of case studies but, in this paper, we move beyond case studies to an analysis of a large number of capitalist firms and worker co-ops in Italy, the

² This negative output-price relation was implied by Ben Ward’s (1958) seminal model of the income-maximizing co-op although he emphasized the sensitivity of this result to the assumptions underlying it. An analysis of the comparative statics of these income-maximizing models of the co-op can be found in Bonin and Putterman (1987), Ireland and Law (1982), and Pencavel and Craig (1994).

³ Another class of explanations has to do with the heightened risk that co-op workers face when their labor income and capital income are subject to the same uncertain forces. The lack of portfolio diversification discourages individuals from lending to such ventures. This explanation is tied to another set of reasons having to do with liquidity constraints: even in the absence of risk, the amount of capital that workers may be able to draw on may limit their enterprise’s opportunities. For these and other reasons, some have conjectured that the prevalence of capitalist firms in market economies is attributable to the special capital market problems faced by worker co-ops.

country with probably the most extensive worker co-ops of any modern market economy.⁴ There are more than 38,000 worker co-ops (including those in agriculture) in Italy (see Ammirato (1996)) and their conspicuous role in the economy has made them a frequent source of study by economists⁵ though never with as rich a data set as is compiled here. In this paper, we combine two surveys, one of workplaces and another of workers, that permit us to follow the same observations over a period of years. By pooling data over thirteen years (from 1982 to 1994), we have observations on about two thousand worker co-ops which we compare with over 150,000 capitalist workplaces. We also have usable observations on an average of almost thirteen thousand individual workers per year, some two to four percent of them working in co-ops. These surveys allow us to match workers with their workplaces and the panel feature of the data means we may control for a number of attributes of firms and of individuals which are intrinsically unobserved by researchers and which we may treat as fixed effects. In all, in these matched worker-workplace panel data, we have the richest set of observations on worker co-ops ever examined by economists.

Our principal goal is to describe empirical regularities regarding wages and employment in co-op and capitalist workplaces and to determine whether the capitalist and co-op establishments exhibit behavior that conform to textbook models economists have proposed. In addition, in view of the importance placed on capital market issues in conjectures offered about the infrequency of worker co-ops as an organizational form, we examine differences in the physical capital inputs of capitalist and co-op enterprises. There is a growing literature using micro-economic data to examine the implications of conventional firms' profit-maximizing behavior⁶ and our research is in this vein.

⁴ Well-known case studies include the Mondragon group in the Basque country of Spain (Whyte and Whyte, 1991), the plywood co-ops in the Pacific North-west (Pencavel, 2001), the sanitation workers in the San Francisco Bay Area (Russell, 1985), and the kibbutz in Israel (Warhurst, 1999).

⁵ See, for instance, Bartlett *et al.* (1992) and Jones and Svejnar (1985).

⁶ See, for instance, the research reviewed in Bond and Van Reenan (2005).

II. Economic Models of the Capitalist Firm and Worker Co-op Compared

The purpose of this section is to lay out and contrast the principal implications of economists' basic models of the capitalist firm and the co-op. These models are elementary, perhaps naive, and ignore many of the complexities of these firms and their environments. However, these models provide the workhorses for much economic analysis and it is important to determine their empirical relevance. Our primary question is whether orthodox models of the co-op and capitalist enterprise conform to the observations we have collected. In particular, we focus on labor market outcomes relating to wages and employment and on the use of capital by these firms.

The Capitalist Firm

First consider the prototypical capitalist firm as spelled out in micro-economic textbooks in which E denotes the firm's employment of labor, K its services from physical capital, and Q_i the level of its i th other input ($i = 1, \dots, n$). The transformation of inputs into output, X , is described by a smooth production function: $X = X(E, K, Q_1, \dots, Q_n)$. The price per unit of output is p , the wage paid to each labor input is w , r is the rental price of capital, q_i the per unit price of each unit of Q_i , and F denotes the firm's fixed contractual costs. In the classical case, these monetary values - p , w , r , q_i , and F - are given to the firm and define its economic environment. In particular, this textbook model of the firm assumes all labor may be hired at the given price w , that is, the firm's labor supply function is horizontal at the wage w : $w = w(Z^S)$ where Z^S denotes variables that shift the firm's labor supply function. The wage paid to each of the firm's employees depends on Z^S , but is independent of p , r , q_1, \dots, q_n , and F . As we shall note below, this property is not shared with the standard model of the co-op. Treating w as fixed in this firm's optimizing problem does not necessarily require that the firm's labor supply function be horizontal; it follows also if collective bargaining at the industry or regional or national level (as is typical in Italy) determines the wage that the capitalist firm must pay.

The capitalist firm selects its inputs to maximize net revenues: $\Pi = p.X(E, K, Q_1, \dots, Q_n) - w.E -$

$r.K - \sum_i q_i \cdot Q_i - F$. The resulting labor demand and capital services functions may be written:

$$E = E^\pi(p, w, r, q_1, \dots, q_n) \text{ and } K = K^\pi(p, w, r, q_1, \dots, q_n).$$

Provided certain regularity conditions are satisfied, the labor demand function has the following properties: E is increasing in p (unless labor is an inferior input) and decreasing in w . Analogously, according to the capital services demand function, K is normally increasing in p and decreasing in r . Provided $\Pi \geq 0$, E and K are independent of F , an important qualitative implication.

The Worker Co-op

Consider the twin worker-owned firm that operates in the same market environment with the same production function as the capitalist firm just described.⁷ There are two models of the worker co-op that might be entertained. In one, there is assumed to be a market for co-op membership and the prices of each co-op's shares fluctuate in response to the changes in expectations about an enterprise's fortunes.⁸ The shortcoming with maintaining this model for our purposes is that there is little evidence of such markets for membership in the Italian case. There are admission fees to most Italian co-ops and each member is required to contribute some of the enterprise's financial capital. However, these contributions do not constitute market membership prices because Italian law specifies both minimum and maximum amounts that new members must advance to their co-ops. Furthermore, upon leaving the enterprise, normally the individual gets back what he put in (less the admission fee) and what he receives is independent of the future stream of the enterprise's net returns. Hence, an unregulated market for tradeable co-op membership rights does not exist in Italy.⁹

⁷ An issue deferred to future research is whether the internal operations (the production functions) of co-ops are less or more efficient than those of capitalist enterprises.

⁸ See, for instance, Sertel (1982) and Fehr (1993).

⁹ The absence of a "thick" market in membership rights may not be the consequence of the legal structure; on the contrary, the legal structure may reflect the deeper problems in markets for co-op membership. Unlike a capitalist firm, the right to a portion of a co-op's net receipts entails not only the ownership of the share but also requires the individual to supply his labor to the co-op so the

In the second model of the worker co-op and the one investigated here, the co-op's rules on membership are specified by the legal system and, taking these rules as given, the co-op is assumed to maximize income per worker-member so that members have equal shares. In this event, the levels of E, K, Q_1, \dots, Q_n are selected to maximize per worker net revenues, v :

$$v = E^{-1}[p.X(E, K, Q_1, \dots, Q_n) - r.K - \sum_i q_i Q_i - F]$$

where labor cost does not enter as an expense in computing net revenues.¹⁰ The employment demand function and capital services demand function for the worker co-op may be written

$$E = E^v(p, r, q_1, \dots, q_n, F) \quad \text{and} \quad K = K^v(p, r, q_1, \dots, q_n, F).$$

For the worker co-op, increases in p do not necessarily increase the demand for workers (even if labor is not an inferior input). Indeed, in the special case in which all the Q 's are fixed, increases in p reduce the optimal E , a property first derived by Ward (1958) and the object of much research (most of it theoretical) since. Unlike the profit-maximizing capitalist firm, the worker co-op increases E in response to an increase in F .¹¹

exchange of a co-op's share involves substituting one individual's labor supply for another's. Hence factors that inhibit labor mobility contribute to a "thin" market for co-op membership shares. In these circumstances, competition for co-op membership shares may be less common than bilateral monopoly so the legal system may be more inclined to regulate the market for membership rights.

¹⁰ In operation, a worker in a typical co-op receives as compensation, v , a regular wage, w^* , and an occasional dividend, Π^*/E , so that $v = w^* + \Pi^*/E$ where $\Pi^* = \Pi - w^*E$ and $\Pi = p.X - w^*.E - r.K - \sum_i q_i Q_i - F$. But then $v = E^{-1}[p.X - r.K - \sum_i q_i Q_i - F]$ which is the co-op's maximand in the text.

¹¹ Some intuition for the positive effect of F on v is as follows. Write the objection function, v , as consisting of two additive parts: the first part is $[p.X(E, K, Q_1, \dots, Q_n) - rK - \sum_i q_i Q_i]/E$ and the second part is $-F/E$. The first part is value added per worker and, because of a tendency towards decreasing returns to labor, this will be kept higher at lower levels of employment (at least over a range of employment). This part encourages a low level of E . The second part is $-F/E$ and the presence of fixed costs, F , inclines the co-op to employ a large number of workers so that fixed costs per worker, F/E , may be spread over a large number of workers. This second factor encourages a high level of employment. These two forces pull in opposite directions and the optimum of E constitutes a balance of these two forces. When F increases, the first force is unaffected (F does not appear in the first part), but the second force increases in importance because a higher F means

The co-op's capital services demand function possesses few qualitative properties unless restrictions are placed on the form of the production function. If $\partial^2 X / (\partial E)(\partial K)$ is positive as many would surmise so that labor and capital are complementary in the production function, then the co-op's demand for capital is a negative function of r and a positive function of F .¹²

If the optimal values of E, K, Q_1, \dots, Q_n are substituted into the co-op's objective function, the maximized value of v - call this v^* - may be written indirectly as a function of the predetermined variables: $v^* = \varphi(p, r, q_1, \dots, q_n, F)$. In this way, when firms are price takers in all markets, changes in these prices induce changes in the earnings of each co-op worker. By contrast, in the same market environment, the wages of the worker in capitalist firms are independent of firm-specific changes in market prices. For these reasons, the wages of co-op workers are expected to be more variable than the wages of workers of capitalist firms. More specifically, the maximized value of v is increasing in p and decreasing in r, q_i , and F .¹³

Figure 1 graphs the difference between employment in the capitalist and the co-op firms. For the capitalist firm, the first-order condition governing the determination of employment is $p.MPE = w$ where $MPE = \partial X / \partial E$. If the wage facing the capitalist firm is w , its optimal employment is $E(w)$. The first-order condition for the income-maximizing co-op is $p.MPE = v$. In Figure 1, R denotes net revenues $[p.X(E, K, Q_1, \dots, Q_n) - r.K - \sum_i q_i Q_i - F]$ and R/E are net revenues per worker. $R/E = v$ is maximized where employment is $E(v)$. Because $v^* \geq w$, employment at w is not less than employment at v^* or employment in the capitalist firm is not less than employment in the co-op.¹⁴ In Figure 1,

greater fixed costs per worker. This inclines the co-op to employ more workers.

¹² The role of $\partial^2 X / (\partial E)(\partial K)$ in deriving qualitative implications of the income-maximizing co-op's behavior is discussed in the Appendix to Pencavel and Craig (1994).

¹³ In fact, v^* is convex in p, r , and q_i . See Pencavel and Craig (1994).

¹⁴ If w exceeds $R/E (= v^*)$, the capitalist firm would earn negative profits and prefers to cease production. Hence $v^* \geq w$.

because v^* is strictly greater than w , employment at w is strictly greater than employment at v^* .

Some Complications about Wage Differentials

This model of the co-op assumes the worker-owned enterprise can achieve its income-maximizing goal without any labor supply constraints. However, Figure 2 graphs a situation in which the maximum value of v is not feasible. Given the labor supply function denoted $S(v)$ in Figure 2, the maximum attainable earnings are v' . Constrained employment is E' instead of E^* . With such labor supply constraints, the location of the $S(v)$ function becomes relevant to the earnings-employment outcome: the co-op's earnings v' may now be greater or less than the capitalist firm's wages, w .

This ambiguity about the capitalist-coop wage differential is reinforced if non-pecuniary conditions of employment in the co-op are valued differently from those in the capitalist enterprise. Insofar as workers place a value on participating in the co-op's governance, they will be willing to work at different wages from those prevailing in the capitalist enterprise. Or, as noted above, the model of the income-maximizing co-op implies that the co-op's wages respond to firm-specific prices and fixed costs and, therefore, they tend to fluctuate more than wages in capitalist firms. Other things equal, these greater wage fluctuations are inclined to mitigate employment variations. Consequently, workers may view the risk of employment loss in the co-op as less than that in the capitalist firm and, accordingly, be willing to work in the co-op at lower wages than those in capitalist firms. These considerations frustrate clear predictions about the sign of the capitalist-coop wage differential.

These complexities obscure the implications from simple models about capitalist-coop wage differentials and they are exacerbated if we allow a role for unions to affect wages. Most Italian workers are covered by collective bargaining agreements that apply to all firms in a given industry and/or region. Typically these agreements stipulate minimum rates of pay. Sometimes, through plant level bargaining, wages in a particular workplace may "drift" above the floor established in the multi-employer bargaining contract. In other instances, especially in small establishments, the terms of

collective bargaining agreements may be disregarded. The result is that actual pay differentials across establishments in the same industry are greater than those specified in the multi-employer agreements.

In the period of our study, co-ops were not legally required to adhere to the minimum rates of pay set down in industry-wide union contracts although a number of them did. While in many cases workers in co-ops are affiliated with the relevant industrial union, the co-op workers tend to display less militancy than workers in capitalist firms. This has caused “frustration [among union leaders] that co-operative workers must, of necessity, opt out of an active role in trade union affairs in favor of the struggle to make their enterprises commercially viable” (Thornley, 1983, p. 332). The ability of co-ops to ignore union-negotiated pay scales and the less militant posture of co-op workers lead to the conjecture that wages in co-ops may lie below those in capitalist workplaces.

The upshot of this discussion is that theoretical reasoning cannot provide a qualitative prediction about whether wages are higher or lower in the capitalist firm than wages in its co-op twin.

Summary

This exposition of the conventional models of the profit-maximizing capitalist firm and the income-maximizing worker co-op suggests the following differences between them concerning employment, wages, and the use of capital. We focus on those differences that our data subsequently permit us to address. First, with respect to wages:

- In the capitalist enterprise, the wage depends on supply-side variables Z^S , but is independent of the firm-specific values of p , r , q_i , and F . In the co-op, the wage depends on the co-op’s p , r , q_i , and F . In particular, the wages of co-op workers are a negative function of both r and F .
- In the absence of labor supply constraints and collective bargaining, wages in the co-op are not less than those in the capitalist enterprise. However, when the labor supply function acts as a constraint on employment for the co-op or when a role is admitted for collective bargaining, the capitalist-coop wage differential is ambiguous in sign.

Second, with respect to employment:

- In the capitalist firm, employment is a negative function of the wage rate. In the co-op, employment and wages are jointly determined variables and causation does not run simply from wages to employment. The sign of the correlation between wages and employment among co-ops is unspecified.
- In the capitalist firm, employment is independent of fixed costs, F (provided $\Pi \geq 0$.) In the co-op, employment is a positive function of F .
- In the model of the capitalist firm just sketched, because wages are given to the enterprise, product demand shocks - as represented by transitory changes in p - induce the firm to make quantity - including employment - reactions. That is, in the capitalist firm, employment (and other input quantities) will tend to take the brunt of product market shocks to the firm's economic environment while, in the co-op, such shocks will have a first-order impact on each member's wages. These impacts on the co-op member's wages will temper employment responses. Expressed differently, in the co-op, wages will tend to be more responsive and employment less responsive to product market shocks than the wages and employment of workers in the capitalist firm.

Third, with respect to the use of physical capital,

- In the capitalist firm, K is decreasing in r and independent of F (provided $\Pi \geq 0$) . In the co-op, if labor and capital are complementary inputs in the production function, then the co-op's demand for capital is a negative function of r and a positive function of F .

Before we examine the empirical relevance of these implications, because the co-ops are a less familiar organizational form, consider the following description of the Italian co-op movement.

III. Worker Co-ops in Italy

Brief History

The cooperative movement in Italy dates back to mutual aid and insurance societies in the nineteenth century. A confederation of cooperatives was established in 1886 and this later became La

Lega (Nazionale delle Cooperative), the largest umbrella organization of co-ops today. The confederation's principal function was to act as a pressure group on government and, indeed, legislation was secured granting co-ops exemption from certain taxes and providing them with preferential access to public works projects. Favored in this way by the state and enjoying widespread ideological approval from diverse sources, the cooperative movement grew such that by 1921 some 20,000 co-ops were operating in Italy (Ammirato, 1996, p. 78). The period of Fascist rule was largely accompanied by their suppression, but they recovered after the overthrow of Mussolini and, again, the state granted co-ops certain favors.¹⁵ At the same time, Christian Democratic governments viewed some confederations of co-ops as strongholds of the Communist Party and sought to withhold privileges from them.

The political climate became more favorable to co-ops in the 1970s and they secured further tax advantages including the avoidance of all taxes on surpluses channeled to the reserves.¹⁶ Public works projects (transport, housing, and schools) were steered toward worker co-ops and, to counter unemployment among young people, the state provided financial support to youths starting cooperative ventures. Between 1977 and 1979, almost 1,300 co-ops were formed in this manner (Ammirato, 1996, p. 95). The environment of the 1980s was less hospitable to the co-ops. Correction of the state's fiscal deficits implied less financial support for co-ops and, as a consequence, they modified their vision. They tried to shed their image of working class culture and aversion to private enterprise and they adopted a posture that applauded economic efficiency and financial incentives. Co-op members were encouraged to view their organization as purely a financial investment and monetary incentives were

¹⁵ The Basevi Law of 1947 granted co-ops tax benefits, the amount of which depended on the importance of labor costs in total costs. At maximum, a co-op was exempted from paying all taxes if labor costs represented 60 percent or more (reduced to 50 percent or more in 1992) of total costs (excluding raw material costs). The law also regulated other financial aspects of co-ops including the amount that each worker could invest in the organization and the maximum interest that he could earn on this capital. These limits were eased in 1971.

¹⁶ Excluded from taxes were profits reinvested in the enterprise and three percent directed to the "cooperation and mutuality fund".

provided to bolster this view. Increasingly, supervisors with a practical business mentality were hired into the co-ops from outside the co-op movement.

The data in Table 1 indicate that, over the period of our empirical analysis (that is, from the early 1980s to mid-1990s), worker co-ops have been growing in Italy. Nevertheless, by 1996, employment in co-ops constitutes only four percent of total employment. Co-ops are more heavily represented in Construction, Transport, and some Service industries.

Structure of Co-ops

According to Italian law, each co-op may determine its own rules of association and by-laws although statute law specifies certain key aspects of the cooperative structure. Membership in a co-op requires that an individual provide a portion of its capital. Sometimes an admission fee may also be required of a new member. A member who leaves the co-op is repaid the value of his contributed capital. Co-ops are required to allocate at least 20 percent of each year's net revenues to its reserves. Profits paid into these funds are absolved from corporate income tax. Net revenues in excess of that paid into reserves may be distributed to working members in proportion to their work and dividends may be paid on capital provided.¹⁷

Decisions about the distribution of net revenues are made by each co-op's General Assembly. Each member has one and only one vote. Almost all co-op workers are members.¹⁸ Non-members include apprentices and probationary workers. Most co-ops distribute profits to members and non-members on the same terms, but there may be bonuses that members enjoy. Only members may loan

¹⁷ Italian law specifies limits to distributions in the form of dividends. Usually, a member-worker may receive on his contributed capital no more than the rate paid on Treasury or Postal bonds.

¹⁸ Thus, in the survey undertaken by Bartlett *et al.* (1992) in the mid-1980s of 49 co-ops in Tuscany and Emilia-Romagna, on average about 85 percent of workers were members. "In most Lega co-ops three quarters of the workers are members and the rest will be. When someone becomes eligible for membership, a councillor or senior member invites him to apply. There are seminars on the rights and responsibilities of membership....." (Holmström (1989)p. 91.)

to their co-ops and the loan pays a higher, tax-free, interest than conventional banks. Following an adverse shock, non-members are much more likely than members to lose their jobs.¹⁹ When members do lose their jobs, the co-op will encourage another co-op to hire them. Co-ops are not covered by employment protection legislation so laid off co-op workers are not entitled to severance pay.²⁰

By vote, the General Assembly selects a Council, the co-op's principal supervisory body which meets weekly or fortnightly. It appoints the managers and specifies general policies. In most co-ops, one managerial position, the President, is elected, not appointed, by the Council. Descriptions of co-ops suggest extensive participation by co-op members in decision-making and considerable turnover of officers.²¹

Many co-op members also belong to a federated labor union. Typically, basic pay scales are negotiated by the national union and the relevant confederation of employers at the regional or national level, but supplementary payments are determined inside the enterprise together with promotions, working conditions, and grievances. So earnings may exceed the regionally-negotiated or nationally-negotiated minima and there may be considerable differences in pay across firms in the same industry or region. When wages tend to lie above those set down in multi-employer collective bargaining agreements, it is difficult to know the extent to which the wage structure diverges from that which would obtain in the absence of unionism.

Within the co-op, the union may have a well-defined role in serving the interests of workers who

¹⁹ "The main practical advantage of membership is security. While co-ops are reluctant to shed labor in any circumstances, if it must be done there is no doubt that members are better protected." (Holmström (1989), p. 92.)

²⁰ This description applies to the period of our data analysis, namely, from 1982 to 1994. However, subsequently, several judicial and legislative decisions in the 1990s changed a number of the rules. Legislative changes in 1998 specified that co-op workers are covered by most of the collective bargaining rules and employment protection legislation that apply to workers of capitalist firms.

²¹ For instance, see the co-ops described in Holmström (1989).

are not members although, usually, these constitute a small minority of a co-op's work force and, in any event, most non-members aspire to and will become members. The union may also have a role if the co-op's representation mechanisms are not functioning well and a group of workers feel their interests are being slighted. However, a basic co-op principle is that workers participate in the enterprise's governance and, if the mechanisms for worker participation are functioning as designed, it is not clear what constructive role can be played within the co-op by a union. A union's role as watchdog of management seems anomalous when the workers select and have the authority to dismiss the managers.²²

IV. Two Sources of Data

Two types of data are exploited in this paper. One is an annual survey of companies and the other is an annual survey of workers. The survey of workers is based on Social Security records and contains an employer tax code and this permits us to match this worker information with attributes of the firm. Moreover, this information is available for a number of years which allows the construction of panel data. Hence we are able to work with a matched employer-worker longitudinal data set. Consider first the information contained in the company survey.

The Survey of Companies

The company data are drawn from the archives of the Italian Company Accounts Data Service which collects balance sheet information and other items on over 30,000 Italian firms. Available since 1982, the data are gathered by Centrale dei Bilanci, an organization established in the early 1980s jointly by the Bank of Italy, the Italian Banking Association (ABI), and a pool of leading banks to construct and share information on borrowers. Besides balance sheet items, there is information on the level of employment, on the establishment's flow of funds, and on various attributes of the firm such

²² For a discussion of the role of the labor union in a worker co-op in Italy, see Holmström (1989, pp. 89-108) and Thornley (1983). Earle (1986) provides some case studies.

as the year founded, its location, the legal form of organization, its ownership status, and its structure of control. The entry on the legal form of organization allows the identification of co-ops.

Balance sheets for the banks' major clients (defined according to the level of borrowing) are collected by the banks. The focus on the level of borrowing skews the sample towards larger firms. Furthermore, because most of the leading banks are in the northern part of the country, the sample has more firms headquartered in the North than in the South. Finally, because banks deal mainly with firms that are creditworthy, firms in default are not in the data so that the sample is tilted towards more creditworthy borrowers. Even with these restrictions, these data provide a very comprehensive description of Italian firms. The firms included in the sample account for more than fifty percent of total employment (Cingano and Schivardi, 2004).

Descriptive statistics on the firm sample for three representative years are provided in Tables 2 and 3. Table 2 relates to all the firms and Table 3 restricts the data to the matched firms, that is, those companies for which observations on workers are also available.²³ Because the probability of matching a worker with a company rises with the size of the company, the establishments in the matched sample in Table 3 are larger than those in Table 2. Average and median employment in the co-ops tends to be larger than in the capitalist firms. The empirical frequency distribution of companies by employment reveals that there are a few capitalist firms with extremely high levels of employment, but these are offset by a large number of very small capitalist workplaces.

What is called "wages" in Tables 2 and 3 is, in fact, total annual labor costs per worker and, although these labor costs consist principally of labor earnings, they also include taxes on labor. For the co-ops, these wages include dividends distributed to workers. Usually, these wages are higher in co-ops. However, these comparisons hold nothing constant. In fact, the industrial distribution of

²³ Eliminated from the company data are those with missing information on the variables listed in Tables 2 and 3. The survey does not cover the public sector.

capitalist and co-op firms is quite different and these differences alone will give rise to wage differences: the capitalist firms are concentrated in manufacturing whereas there are relatively more co-ops in construction and the retail industry.

Capital (measured in billions of 1982 lira) consists of the value of land, buildings, office equipment, machinery, vehicles, and patents. According to Tables 2 and 3, usually the average stock of capital is greater in the capitalist enterprises than in the co-ops while the median stock of capital is higher in the co-ops. However, these comparisons in the capital stock reflect in part the different production technologies across industries with capitalist enterprises more heavily represented in manufacturing and co-ops in retail industry and in construction. To assess whether co-ops are relatively undercapitalized and whether input combinations are systematically different across the two types of firms, we form the ratio of capital to employment for each firm and average it over all years observed. Then we regress this average capital-labor ratio on industry dummy variables to remove the effects of industry-specific technologies. Finally we plot the frequency distribution of the residuals from this regression separately for co-ops and for capitalist firms. This is shown in Figure 3.

According to Figure 3, capital-labor ratios in co-ops display a wider dispersion than those in capitalist enterprises: there are relatively more co-ops with very low capital-labor ratios (at the left tail of the distribution), but also relatively more co-ops with very high capital-labor ratios. According to these data, input ratios are different in co-ops from those in capitalist firms, but these differences are not well described by simply characterizing co-ops as using less capital relative to labor.

In our fitted equations below, we make use of the rental price of capital and of fixed costs. For the former, we define a comprehensive measure of the user cost of capital for enterprise j in year t that takes account of taxes, investment credits, depreciation allowances, financial debt, depreciation, and

each firm's reported borrowing rate.²⁴ This unusually precise measure of the user cost of capital is denoted r_{jt} and it is a rate with a mean value of 0.197.

To measure fixed costs, F_{jt} , we use each company's long-term debt payments in each year (measured in real terms). These long-term debts represent contractual payments the firm must make on its commitments from previous years and they correspond to the unavoidable nature of fixed costs in economic models of the firm. These expenditures must be made regardless of the enterprise's decisions and actions and match the notion of "sunk costs are sunk". The mean of F_{jt} is 0.005 and its frequency distribution is skewed to the right with 25 percent of observations with a value of F_{jt} of zero. This definition of fixed costs is the best available in these data.²⁵ To ensure our results with respect to other relationships are not the consequence of the presence of this particular way of computing fixed costs, all the equations reported below were estimated also by omitting this measure of F_{jt} .

The argument in Section II also alluded to the effects on wages and employment of transitory product market shocks. With the available data, such shocks for each firm in a given year are measured by the deviation of its sales in that year from that predicted by a linear regression. More precisely, we regress the logarithm of real sales on a firm fixed effect and a linear time trend and allow this trend to be different across industries and across regions of the country. Then we measure product market

²⁴ To be precise, the user cost of capital for establishment j in year t is given by

$$r_{jt} = (1 - s_{jt})(1 - \tau_{jt})^{-1} [g_{jt}i_{jt}(1 - \tau_{jt}) + (1 + g_{jt})e_t - \pi_{jt} + \delta_{jt}]$$

where s reflects corporate tax rates, investment tax credits, depreciation allowances and subsidies (which vary by region), τ is the corporate tax rate, g is the ratio of financial debt to total liabilities, i is the average borrowing rate paid by the firm, e is the nominal return on equity (the yield on Italian Treasury bonds), π is the sector-specific expected increase in the prices of capital goods (from the Bank of Italy survey of investment in manufacturing), and δ is the sector-specific rate of depreciation.

²⁵ F_{jt} is defined as $(D_{jt}J_t)/(ppi)_t$ where $(ppi)_t$ is the producer price index, D is the stock of long-term debt to all financial intermediaries, and J is the long-term nominal interest rate on borrowing. The latter is regarded as confidential information and is unavailable for each establishment so we use the economy-wide medium and long-term rate on bank borrowing. Fixed costs are measured in hundred billions of 1982 lira.

shocks for each firm in each year by the deviation of the logarithm of real sales from the value predicted from this regression (including the firm's fixed effect).²⁶ In our estimating equations below, this variable is denoted by S_{jt} , an indicator of firm j 's transitory shocks in the product market in year t , and, in Tables 2 and 3, this variable is labelled "product market shock".

The Survey of Workers

The Italian National Institute for Social Security (Istituto Nazionale della Previdenza Sociale) requires firms to file a yearly report (form O1M) for each worker on their payroll. The data are used to estimate the amount of withholding tax the employer has to pay on behalf of the employees and to INPS as contributions for pensions and health insurance. The forms filled out by the employer are roughly comparable to those collected by the Internal Revenue Service in the U.S. However, while U.S. administrative data are usually provided on a grouped basis, INPS has truly individual records. Moreover, in the U.S., earnings records are censored at the top of the tax bracket while the Italian data are not subject to top-coding.

The data cover the universe of employees in the private sector (thereby excluding the self-employed, public employees, and "off-the-books" work). Our observations are a sub-sample of the universe based on workers born on two particular days of the year. The data are available on a continuous basis for the 1974-1994 period. We restrict the data to cover the period from 1982 to 1994 so that they can be paired with the establishment data. The form reports information on each worker's annual earnings and on the number of days and weeks worked.²⁷

²⁶ Other specifications of the equation imputing product market shocks were applied with small consequences for the estimates reported below. Of course, if S_{jt} were pure measurement error, it should be uncorrelated with wages and employment.

²⁷ Information on hours worked is not available though there is less variation in hours worked in Italy than in many other countries. Wages consist of two components: normal and occasional. Occasional wages include sums drawn from the wage supplementation fund for laid-off or short-time workers, seniority and loyalty premia, one-time bonuses, moving expenses and business travel refunds, the monetary value of goods in kind, and allowances for lost tips and commissions. On

Workers are identified by broad job category: apprentices, production workers, clerical workers, and managers. Information on education is unavailable, but days and weeks of work and the date employment ended (if this occurs) are provided. From each worker's social security number, information can be retrieved on the worker's gender, year of birth (and thus age), and place of birth. Finally, the employer's tax code allows us to match information on the worker with that of the firm.

Table 4 presents information on the characteristics of workers where we focus on those workers who can be matched with their workplaces. Whereas the unit of observation in Tables 2 and 3 is the company, the unit of observation in Table 4 is the worker.²⁸ According to the observations on workers, average and median wages are a little lower for co-op workers than for workers in capitalist firms. When a simple descriptive regression equation is fitted to the company data and to the worker data, holding constant region and industry, the wage difference between the co-ops and the capitalist enterprises measured in the company data and in the worker data is similar.²⁹

V. Empirical Specifications for Wages

The arguments in Section II suggested that wages in the co-ops would exceed those in capitalist firms unless (*i*) co-ops were constrained by labor supply limitations and non-pecuniary differences

average, occasional wages are less than 10 percent of the total. Our measure of gross wages is the sum of the two components. For co-op workers, wages include dividends distributed to them by their firm where the information about dividends comes from the company data set.

²⁸ In the worker data set, those aged less than 18 years and more than 65 years are omitted as are all those observations lacking data on wages and the extent of work in the year.

²⁹ More precisely, for the data on individual workers, we regressed the logarithm of real annual wages on industry dummy variables, regional dummy variables, calendar year dummy variables, and a dummy variable taking the value of unity for a co-op observation. Similarly, for the data on establishments, we regressed the logarithm of real annual labor costs per worker on the same set of variables. In the former regression, the estimated coefficient on the co-op dummy was -0.083 (with an estimated standard error of 0.015) and, in the latter regression, it was -0.016 (with an estimated standard error of 0.007). Given the different concepts, it is natural that the two estimates should not be identical. However, they are similar in magnitude and suggest that the "raw" differences in Tables 2 and 4 conceal basic similarities.

between co-ops and capitalist firms were offset by wage differences or (ii) collective bargaining raised wages in capitalist enterprises above those in co-ops. In addition, Section II surmised that, whereas wages in capitalist firms are independent of variations in the prices of non-labor inputs (in particular, of r_{jt} , the user cost of capital) and of fixed costs, F_{jt} , the wages of co-op workers are a negative function of both r_{jt} and F_{jt} . Also, the models of the capitalist firm and the worker co-op in Section II hypothesized that wages would tend to be more volatile in the co-op. That is, when the capitalist firm operates with a horizontal labor supply curve, wages in the capitalist firm are independent of shocks to the firm's labor demand function. Such shocks will have first-order impacts on employment, hours, and other input quantities such as capital. By contrast, in the co-op, shocks to labor demand will directly be transmitted to the co-op workers' wages.

Using these data to address these issues, our observations on wages describe worker i in company j in calendar year t . These are unbalanced data because a worker may not be observed in every year. An equation that provides a method to investigate these differences in wages among individuals in capitalist firms and worker co-ops is the following:

$$(1) \quad \ln w_{ijt} = x_{ijt}\alpha + z_{jt}\beta + r_{jt}\gamma_1 + F_{jt}\gamma_2 + S_{jt}\gamma_3 + C_{ijt}\theta_0 + r_{jt}C_{ijt}\theta_1 \\ + F_{jt}C_{ijt}\theta_2 + S_{jt}C_{ijt}\theta_3 + v_i + \varepsilon_{ijt}$$

where $\ln w$ stands for the logarithm of real wages, x are observed characteristics of the individual worker, z are observed features of the enterprise where the individual works, and C is a indicator taking the value of unity when individual i works in a co-op. r_{jt} is the user cost of capital, F_{jt} is fixed costs, and, as described in Section IV, S_{jt} is our measure of observed transitory shocks to firm j 's product market in year t . Factors that affect wages but are unobserved by the researcher are represented by v and ε . Unobserved factors that vary across people but are fixed for a given individual over time are denoted by v . ε represents unobserved factors that vary over people in different firms and over time.

The arguments in Section II suggested that the wages of workers in capitalist firms would tend to be insensitive to differences in r and F whereas the wages of workers in co-ops would tend to be a negative function of both r and F . If this is the case, $\gamma_1 = \gamma_2 = 0$ while θ_1 and θ_2 are each negative. Analogously, Section II reasoned that transitory shocks in product markets would tend to affect wages more in co-op enterprises and employment more in capitalist enterprises. This would suggest that θ_3 is positive. The wage differential between workers in capitalist firms and those in co-ops depends upon the estimates of θ_0 , θ_1 , θ_2 , and θ_3 .

Because v is unobserved, least-squares estimates of θ_0 in equation (1) are biased if v is correlated with C . For example, if wages are more volatile in co-ops, other things equal, more risk-averse people may seek employment in a capitalist enterprise. If, in turn, attitudes toward risk are absorbed in v , then the equation's unobserved components will be correlated with C .³⁰ Our panel data permit us to observe workers when they move across firms so the correlation between v and C can be addressed by averaging variables over time and writing (1) as

$$(2) \quad \ln w_{ijt} - \ln \bar{w}_{ij} = (x_{ijt} - \bar{x}_{ij})\alpha + (z_{jt} - \bar{z}_j)\beta + (r_{jt} - \bar{r}_j)\gamma_1 + (F_{jt} - \bar{F}_j)\gamma_2 + (S_{jt} - \bar{S}_j)\gamma_3 + \\ (C_{ijt} - \bar{C}_{ij})\theta_0 + (r_{jt}C_{ijt} - \bar{r}_j\bar{C}_{ij})\theta_1 + (F_{jt}C_{ijt} - \bar{F}_j\bar{C}_{ij})\theta_2 + (S_{jt}C_{ijt} - \bar{S}_j\bar{C}_{ij})\theta_3 + (\varepsilon_{ijt} - \bar{\varepsilon}_{ij})$$

where a bar over a variable indicates an average over time. The movement of workers between co-ops and capitalist firms allows us to estimate the θ 's. (That is, without such worker mobility, C_{ijt} would equal its mean value over the period.) This within-group specification is a familiar technique with panel data although it comes at the cost of being unable to measure the association between wages and variables that remain unchanged over time (such as a worker's immutable demographic

³⁰ The sign of the bias depends on the relationship between wages and risk aversion. Suppose those who are less risk averse receive higher wages (though with greater variance) and suppose such individuals are more inclined to work in co-ops. Then the bias of the least-squares estimate of θ_0 that ignores unobserved heterogeneity will tend to be negative. That is, if the true value of θ_0 is positive, the estimate of θ_0 that ignores this form of unobserved heterogeneity will be lower than the true value.

characteristics).³¹

Parameter estimates of equations (1) and (2) are contained in the top panel of Table 5 and their implications are given in the bottom panel of Table 5. In addition to the co-op dummy, C , wages are related to the worker's age, gender, occupation, industry, location, and to the company's size (the logarithm of the workplace's employment), its user cost of capital, fixed costs, and deviations in the logarithm of its real sales. The estimates of equation (1) are given under the columns "ordinary least-squares" which suggest that, other things equal, a worker in a co-op earns fifteen or sixteen percent less than a worker in a capitalist enterprise. However, as argued above, this least-squares estimate may be biased if the factors affecting the choice of employment between co-ops and capitalist firms are correlated with the determinants of their earnings. Equation (2) is designed to address this problem and its estimates are contained in the columns beneath "within-group" in Table 5. The estimated capitalist-coop wage differential falls only slightly to fourteen percent. These estimates of the wage differential would be judged as significantly less than zero by conventional criteria.³²

In the bottom panel of Table 5, $\partial \ln w / \partial r$ and $\partial \ln w / \partial F$ report the impact of the user cost of capital and fixed costs on wages. For workers in capitalist firms, differences in r_{jt} bear no meaningful association with wages. According to the least-squares estimates in columns (1) and (2), in capitalist enterprises, higher values of fixed costs appear to be associated with lower wages. However, this

³¹ What factors affecting wages are neglected in equations (1) and (2)? Suppose worker i is more productive when working in enterprise j than in working in another enterprise and suppose this greater productivity is unobserved to the researcher. Such unobserved match components are not identified in these equations.

³² These estimates of the capitalist-coop wage differential (and, indeed, of the other effects in this wage equation) are sensitive to the point of evaluation. The point of evaluation for the estimates in this table is at sample mean values of r , F , and S in the workers sample. (Note the sample mean value of F at 0.298 is much higher than the mean values reported in Tables 2 and 3. This is because, as mentioned earlier, the distribution of F is skewed to the right and F assumes some very high values for some large firms. Workers in these large firms are observed more frequently in the panel data and this pushes up the sample mean of F in the workers' data set.)

negative association appears to be fragile: it turns positive in column (3) and is insignificantly different from zero in column (4). The within-group estimates in column (4) for daily wages are consistent with the arguments in Section II.

For co-op workers, the effect of differences in F_{jt} on wages is consistently negative. However, the magnitude of the effects is very small. Consider the -0.367 value of $\partial \ln w / \partial F$ in the first column as an example. This implies that, evaluated at the co-op median value of F_{jt} in 1994 (namely, 0.0005), the elasticity of wages with respect to fixed costs for co-ops is -0.00018 or a co-op with ten percent higher long-term debts pays 0.18 percent lower wages to its co-op workers. The effect of variations in r_{jt} on the wages of co-op workers is positive in the ordinary least-squares results in columns (1) and (2) but negative (as implied by the theoretical arguments in Section II) in the within-group estimates in columns (3) and (4). The value of $\partial \ln w / \partial r$ of -0.120 for co-op workers in the third column of Table 5 implies that a co-op with a ten percent higher user cost of capital than another co-op will tend to pay just over one percent lower weekly wages. So relatively large differences in the price of capital are associated with relatively small differences in wages. The within-group estimates confirm a negative association between, on the one hand, differences in wages across co-ops and, on the other hand, differences in r_{jt} and F_{jt} as conjectured in Section II. The economic magnitudes of these associations, however, are not important.

The description of the models of the capitalist firm and the worker co-op in Section II hypothesized that wages would tend to be more volatile in the co-op. In particular, when the capitalist firm operates with a horizontal labor supply curve, wages in the capitalist firm are independent of product market shocks to the firm's labor demand function. Such shocks will have first-order impacts on employment, hours, and other input quantities. This is not the case in the co-op where shocks to labor demand will affect the co-op's wages. The presence of S_{jt} in equations (1) and (2) is designed to measure this. In fact, the estimated values of $\partial \ln w / \partial S$ indicate that wages are responsive to product

market shocks in both capitalist enterprises and in co-ops. However, the positive fillip to wages is larger in the co-ops and, in the within-group estimates, the interaction between S and the co-op dummy is significantly greater than zero (as judged by conventional statistical criteria). In the within-group estimates in columns (3) and (4), the effect of such shocks is roughly twice or three times in co-ops what it is estimated for capitalist enterprises: in co-ops, a positive ten percent product market shock is associated with a one percent higher wages whereas in capitalist enterprises the same shock is associated with between 0.3 and 0.5 percent higher wages.³³ These inferences are insensitive to the presence of fixed costs, F_{jt} , in the equation.³⁴

VI. Empirical Specifications for Employment and Capital

Employment

The models outlined in Section II suggest that, for capitalist firms, a causal relationship from wages to employment exists such that, other things equal, employment is a negative function of wages. For co-ops, each worker's wages are jointly determined with employment in which case a well-defined causal relationship from wages to employment does not obtain. In addition, the models in Section II imply that employment is independent of fixed costs in the capitalist enterprise but is a positive function of fixed costs in the co-op. Furthermore, employment is expected to be more responsive to transitory product market shocks experienced by the capitalist enterprise than the product market shocks experienced by the co-op.

A specification that would permit examination of these differences between capitalist and co-op

³³ This result is compatible with Guiso, Pistaferri and Schivardi's (2003) analysis of the transmission of firms' shocks to wages. They find that permanent shocks to firms' value added are transmitted to workers in the form of changes in their compensation, a finding that may be attributable to risk of bankruptcy and to incentive effects. The magnitude of the effect is small, however, and its estimation does not distinguish between co-ops and capitalist firms.

³⁴ In the within-group estimates corresponding to column (4) of Table 5, when F_{jt} is omitted, the estimated coefficient on S_{jt} is 0.029 and the estimated coefficient on $S_{jr} C_{ijt}$ is 0.074.

enterprises is as follows:

$$(3) \quad \ln E_{jt} = \ln w_{jt} \eta_0 + (\ln w_{jt} C_j) \eta_1 + r_{jt} \eta_2 + (r_{jt} C_j) \eta_3 + F_{jt} \eta_4 + (F_{jt} C_j) \eta_5 + S_{jt} \eta_6 + (S_{jt} C_j) \eta_7 + z_{jt} \psi_1 + \omega_{1j} + v_{1jt}$$

where $\ln E_{jt}$ stands for the logarithm of employment and $\ln w_{jt}$ represents the logarithm of real average annual wages in firm j in year t . The elasticity of employment with respect to wages in capitalist firms is given by η_0 . C takes the value of unity for a co-op and of zero for a capitalist firm. The logarithmic employment-wage association in co-ops is given by $\eta_0 + \eta_1$.

The user cost of capital paid by the firm is given by r , the company's fixed costs by F , and transitory product market shocks by S . Interactions between r and C and between F and C allow the effects on employment of input prices and fixed costs to be different between co-ops and capitalist firms. Interactions between S and C allow the impact of product market shocks on employment to differ between capitalist and co-op firms. z stands for other observed attributes of firms including their regional location and their general industry. Factors affecting the logarithm of employment but unobserved by the researcher are given by ω and v . Those factors specific to each enterprise and constant over time are represented by ω_{1j} . v_{1jt} stands for factors that vary across firms and over time.

A simple way of estimating equation (3) is to first-difference it from one year to the next and thereby eliminate the enterprise fixed effects, ω_{1j} . For the co-op enterprises, wages are jointly determined with employment so we need to recognize the potential correlation between the equation's stochastic term and wage changes.³⁵ We treat the wages of co-ops and capitalist firms symmetrically

³⁵ Note that, in describing employment, we cannot use a within-group strategy as we have done for wages. This is because, in addition to the problem of fixed unobserved heterogeneity, we also have the problem that the wage is endogenous, a problem we address using lagged values of the wage as instrumental variables. The endogeneity of wages means that the wage is contemporaneously correlated with the error term of the employment equation. If we used a within-group strategy to remove the firm fixed effect, our instruments would be invalid (in short panels) because the within-group error term is the deviation of the original error term from its time-series mean and this contains its past values that are correlated with the past values of the wage. A first difference-instrumental

and instrument both $\Delta \ln(w_{j,t})$ and $\Delta \ln(w_{j,t-1})$.³⁶ Using two-year and three-year lagged values of wages as instruments.³⁶ The consequences of this instrumental variable regression are reported in column (A) of Table 6. To help draw inferences from these estimates, columns (A) and (B) of Table 7 list the point estimates and estimated standard errors of the elasticities of employment with respect to w , r , F , and S evaluated at mean and median values of capitalist and co-op enterprise variables.

For capitalist firms, there is a well-defined effect of wages on employment with an employment-wage elasticity of -0.80. For the co-ops, the employment-wage relationship is insignificantly different from zero with a very small point estimate. Employment in the capitalist firms is relatively insensitive to changes in the user cost of capital, r : a ten percent increase in the user cost of capital reduces employment by 0.2 percent. This elasticity is even smaller for the co-ops and its point estimate is virtually zero. The estimates attached to fixed costs imply that, for both capitalist enterprises and co-ops, employment is virtually independent of differences in fixed costs.

According to the estimates of the parameters attached to the transitory product market shock variable, employment in both capitalist and co-op enterprises responds positively to transitory product market shocks. However, the employment response is less for the co-ops than that for the capitalist enterprises and the interaction between the product market shock and the co-op dummy is significantly less than zero. A positive ten percent product market shock is associated with almost four percent greater employment in the capitalist enterprises and about a two-and-one-half percent greater employment in the co-ops. More generally, the estimates suggest that, for the co-ops, employment is relatively insensitive to changes in all the right-hand side variables, a finding that replicates previous research on employment in co-operative enterprises (see Pencavel and Craig (1994)).

variable strategy solves both the unobserved heterogeneity problem and the problem caused by the endogeneity of wages.

³⁶ These are valid instruments if ω_{1j} captures all persistent factors and v_{1jt} is serially uncorrelated. The first-differenced equation also includes regional, yearly, and industry dummy variables.

Capital

A specification analogous to equation (3) may be applied to describe the use of physical capital across enterprises and years:

$$(4) \quad \ln K_{jt} = \ln w_{jt} \mu_0 + (\ln w_{jt} C_j) \mu_1 + r_{jt} \mu_2 + (r_{jt} C_j) \mu_3 + F_{jt} \mu_4 + (F_{jt} C_j) \mu_5 + S_{jt} \mu_6 + (S_{jt} C_j) \mu_7 + z_{jt} \psi_2 + \omega_{2j} + V_{2jt}$$

where $\ln K_{jt}$ stands for the logarithm of capital. Applying the same logic as that for employment, we estimate this equation in first-differences treating $\Delta \ln(w_{jt})$ and $\Delta \ln(w_{jt}) \cdot C$ as endogenous and using two-year and three-year lagged values of these variables as instrumental variables. The resulting estimates of equation (4) are contained in column (B) of Table 6 with their implications presented in columns (C) and (D) of Table 7.

For the capitalist firms, the demand for capital with respect to the user cost of capital is negative, the coefficient on wages is also negative so that capital and labor are complements (as implied also by the estimates in column (A) for employment), and capital is relatively unresponsive to differences in fixed costs. For the co-ops, the point estimates suggest that differences in fixed costs have larger effects on capital for the co-ops than they do in the capitalist enterprises although these co-op estimates are not calculated with precision. The association for co-ops between capital and wages is positive, something fully compatible with the income-maximizing co-op because, for the co-op, wage income enters the co-op's objective function. The elasticity of demand for capital with respect to the user cost of capital is similar in value for the co-ops as it is for the capitalist enterprises. Transitory product market shocks are associated with about the same changes in capital in the capitalist firms as in the co-ops: a positive ten percent product market shock is associated with two percent greater use of capital in capitalist and co-op enterprises.

Assessment

These results are broadly compatible with the implications sketched in Section II of the simple

models of the capitalist firm and the co-op. Thus, a well-defined impact of wages on employment and on capital is implied by the textbook model of the capitalist firm and this is borne out by the estimates in Tables 6 and 7: a negative employment-wage elasticity and a capital-wage elasticity are measured for capitalist enterprises. Because wages constitute the maximand for a co-op, the model of the income-maximizing co-op developed in Section II does not offer a clear meaning of the effect of the enterprise's wages on employment and capital.

Similarly, it is a fundamental implication of profit-maximizing behavior of the capitalist firm that, among firms remaining profitable, increases in fixed costs have no impact on employment. This is consistent with the very small estimated elasticities of employment and capital with respect to fixed costs. By contrast, increases in fixed costs are predicted to lead to greater employment and greater capital in the co-ops. It takes a very generous reading of our results to determine that this is confirmed. This may suggest a shortcoming of our measure of fixed costs (namely, long-term debt payments) and, indeed, because such long-term debt payments contains the price of financial capital, perhaps its variations embody a price effect and not simply the effect of changes in the enterprise's contractual payments. More generally, for the co-ops, the use of employment and capital is pretty much independent of changes in fixed costs. The estimates of the coefficients on w , r , and S for both capitalist enterprises and co-ops are almost totally unaffected if the variable measuring fixed costs, F , is omitted from the estimating equations.

Finally, employment is somewhat more responsive to product market shocks in capitalist enterprises than in co-ops. This is consonant with the reasoning that transitory shocks affect wages more and employment less in co-ops compared with capitalist firms. Product market shocks are associated with about the same changes in capital in capitalist enterprises as in co-ops.

The estimates of equations (3) and (4) do not, of course, constitute the co-ops' reduced form input demand functions because the co-op worker's wage appears on the right-hand side of these

equations. Least-squares estimates of the coefficients on r , F , and S of the relevant input demand functions for the co-ops are reported in Table 8.³⁷ The signs of each of the estimated coefficients in Table 8 are consistent with the arguments in Section II: employment is a positive function of F and S ; and, assuming labor and capital are complementary in the production function, the demand for capital is a negative function of r and a positive function of F and S . Though the statistical significance of differences in F is questionable, the measured effect of variations in the user cost of capital on the demand for capital is economically meaningful: a ten percentage point increase in the user cost of capital reduces the demand for capital by almost five percent. These co-ops clearly alter their use of labor and capital in response to transitory product market shocks.

VII. Conclusions

Data on individual workers and individual companies have been used to compare the wage and employment outcomes of capitalist enterprises with those of worker co-ops. We also investigate differences in the use of capital. Previous research has relied on case studies to investigate these issues and has not drawn upon such large and extensive data sets on workers and firms as we exploit in this paper. In this sense, our results can claim to constitute general findings about capitalist and co-op enterprises. In organizing our thoughts about these outcomes, we have drawn upon conventional models of the profit-maximizing capitalist enterprise and the income-maximizing worker co-op.

With respect to employment and capital, these models' implications are largely congruous with our empirical findings. That is, well-defined employment-wage and capital-wage relationships are estimated for capitalist firms that may be interpreted as the elasticities of demand for labor and for capital with respect to wages; the employment-wage elasticity is calculated to be -0.80 and the capital-wage elasticity -0.20. The labor demand and the capital demand equations estimated for capitalist

³⁷ These estimates are derived from using only the sample of co-op observations to regress the year-to-year change in employment and the year-to-year change in capital on the first differences in r , F , and S in addition to year dummy variables, region dummy variables, and industry dummy variables.

enterprises suggest that labor and capital are complements as $\partial E/\partial r$ and $\partial K/\partial w$ are both negative.

For co-ops, the partial correlation between wages and employment is essentially zero while capital is higher in those co-ops that pay relatively high wages. According to the income-maximizing model of the co-op, these links between employment and wages and capital and wages are not causal. Consistent with the profit maximization model of the capitalist enterprise, employment and capital in such enterprises are unaffected by changes in fixed costs. Finally, employment is somewhat less responsive to product market shocks in co-ops than in capitalist firms. This is consistent with the popular notion that enterprises where workers command a greater voice will tend to protect workers from employment reductions.

With respect to wages, we hypothesized that capitalist wages would not be correlated with input prices and fixed costs. The results in Table 5 suggest that, in capitalist enterprises, the association between wages and the user cost of capital is certainly weak and the link between wages and fixed costs is fragile, in some instances positive and in other instances negative. As we surmised, wages tend to be more sensitive to product market shocks in co-ops than in capitalist firms. Our simple model of the income-maximizing co-op led us to expect that co-op wages would be negatively associated with input prices and fixed costs and, at least for the within-group estimates, these hypotheses are consistent with our results. However, the magnitude of these links is small: we find that co-ops facing a ten percent higher price of capital tend to pay about one percent lower wages; co-ops with ten percent higher fixed costs pay 0.18 percent lower wages to its co-op workers.

The empirical regularities we have documented have been organized around simple income-maximizing models of the capitalist and co-op enterprises. These models ignore many confounding features such as the costs of making input adjustments and intertemporal considerations. We have also put aside issues associated with bargaining. Moreover, because of lack of data, we have ignored the prices of many other inputs such as raw materials and energy and variations in these other input prices

are unlikely to be uncorrelated with variations in the price of capital. Finally, data limitations have prevented us from seriously investigating the conjecture that co-ops hire better quality workers and that the differences between co-ops and conventional firms reported in this paper may be attributable ultimately to differences in the human capital of workers and in the organizational structures that accompany such skill differences.³⁸ These issues are worthy of further investigation. While not all the implications of these simple models have been found congruent with our empirical results, they have been largely corroborated and, in this sense, testify to the value of these models.

³⁸ See Levin and Tadelis (2002) for this argument.

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Table 1
 Percentage of Co-ops and of Co-op Workers by Industry, 1981-96

sector	co-ops as a % of all establishments			co-op workers as a % of all workers		
	1981	1991	1996	1981	1991	1996
Mining	1.14	2.63	1.16	2.15	3.19	2.56
Manufacturing	1.02	1.17	0.98	1.51	2.11	1.68
Utilities	6.08	6.28	6.35	1.04	0.25	0.27
Construction	0.74	1.53	2.43	4.93	4.61	4.26
Retail	0.27	0.55	0.27	1.44	2.57	2.01
Hotels	0.48	0.67	0.62	1.19	2.16	2.57
Transport	1.15	1.96	2.06	6.55	5.67	8.83
Financial Services	3.29	2.90	1.90	10.09	12.90	14.40
IT & Real Estate	1.84	1.51	1.16	5.92	10.40	12.74
Other services	0.49	0.81	1.52	2.41	3.02	3.63
All sectors	0.61	1.02	1.06	2.50	3.66	4.06

These data are taken from the Italian National Institute of Statistics Census of Industry and Services conducted in 1981, 1991, and 1996.

Table 2 - Descriptive Statistics on Companies: Entire Company Sample

	1982		1988		1994	
	capitalist	co-op	capitalist	co-op	capitalist	co-op
no. of companies	9,320	120	13,282	148	15,874	474
average employment	197	228	152	282	148	219
median employment	68	104	53	139	52	97
average wages	0.0196	0.0240	0.0227	0.0300	0.0292	0.0411
median wages	0.0187	0.0203	0.0217	0.0233	0.0268	0.0267
average capital	6.209	2.916	5.400	6.001	9.230	5.164
median capital	1.102	1.315	0.879	2.094	1.136	1.277
average sales	24.98	21.16	23.40	41.79	26.06	33.88
median sales	6.56	8.69	6.58	15.72	7.50	8.89
average user cost of capital	0.199	0.214	0.182	0.199	0.153	0.147
median user cost of capital	0.183	0.197	0.172	0.192	0.147	0.143
average fixed costs	0.0083	0.0052	0.0036	0.0030	0.0047	0.0030
median fixed costs	0.0007	0.0008	0.0004	0.0011	0.0003	0.0005
average product market shock	0.159	-0.121	0.033	0.027	-0.035	0.025
fraction manufacturing	0.727	0.267	0.697	0.338	0.637	0.249
fraction construction	0.080	0.250	0.085	0.236	0.084	0.192
fraction retail	0.141	0.158	0.157	0.182	0.184	0.243
fraction in North	0.736	0.958	0.723	0.784	0.723	0.705
fraction in Center	0.158	0.017	0.163	0.155	0.161	0.205
fraction in South	0.106	0.025	0.114	0.061	0.116	0.091

Wages are defined as annual labor costs plus dividends distributed to workers in co-ops all divided by employment. All monetary variables are measured in billions of lira except for fixed costs which are measured in hundreds of billions of lira. All monetary variables are deflated by the producer price index (base 1982). Companies are organized into four industry categories: manufacturing, construction, retail, and other. Source: Italian Company Accounts Data.

Table 3 - Descriptive Statistics on Companies: Matched Company Sample

	1982		1988		1994	
	capitalist	co-op	capitalist	co-op	capitalist	co-op
no. of companies	4,797	57	6,850	104	7,836	240
average employment	301	373	235	341	228	284
median employment	103	256	79	199	72	153
average wages	0.0198	0.0245	0.0230	0.0293	0.0293	0.0520
median wages	0.0189	0.0197	0.0221	0.0233	0.0272	0.0260
average capital	9.52	4.23	8.92	6.80	16.32	6.60
median capital	1.48	2.37	1.18	2.89	1.52	1.29
average sales	38.43	29.42	36.03	50.03	40.24	45.55
median sales	8.77	17.65	9.00	18.45	9.92	10.95
average user cost of capital	0.193	0.223	0.178	0.205	0.151	0.148
median user cost of capital	0.180	0.197	0.170	0.193	0.146	0.146
average fixed costs	0.0131	0.0091	0.0058	0.0033	0.0083	0.0043
median fixed costs	0.0010	0.0023	0.0005	0.0013	0.0004	0.0005
average product market shock	0.072	-0.030	0.049	0.037	0.026	0.057
fraction manufacturing	0.772	0.157	0.740	0.307	0.671	0.246
fraction construction	0.066	0.368	0.066	0.240	0.060	0.133
fraction retail	0.113	0.158	0.132	0.221	0.166	0.263
fraction in North	0.737	0.982	0.721	0.807	0.732	0.708
fraction in Center	0.157	0.000	0.164	0.135	0.159	0.208
fraction in South	0.106	0.018	0.115	0.057	0.109	0.083

The matched company sample includes only the companies with one or more observations in the workers' data set for the reference years. Wages are defined as annual labor costs plus dividends distributed to workers in co-ops all divided by employment. All monetary variables are measured in billions of lira except for fixed costs which are measured in hundreds of billions of lira. All monetary variables are deflated by the producer price index (base 1982). Companies are organized into four industry categories: manufacturing, construction, retail, and other. Source: Italian Company Accounts Data.

Table 4
Descriptive Statistics on Workers: the Matched Worker-Company Sample

	1982		1988		1994	
	capitalist	co-op	capitalist	co-op	capitalist	co-op
no. of observations	10,154	163	13,192	304	14,749	544
average wages	12.106	10.480	13.877	11.883	14.708	11.892
median wages	11.813	10.611	13.170	12.444	13.730	11.238
average days worked	254	252	264	251	264	251
median days worked	302	305	312	311	312	311
average weeks worked	45	45	45	43	45	43
average age	37.7	38.2	37.7	36.5	38.0	37.1
fraction male	0.741	0.773	0.742	0.681	0.725	0.662
fraction operatives	0.706	0.644	0.654	0.507	0.610	0.642
fraction clerical	0.281	0.355	0.329	0.484	0.372	0.339

Wages are measured in millions of lira and deflated by the consumer price index (base 1982). For co-op workers, wages include dividends distributed by the co-op. The matched sample includes only workers for whom company information are available for the reference years. Source: Istituto Nazionale della Previdenza Sociale.

Table 5: Estimates of the Wage Equations (1) and (2)

	ordinary least-squares		within-group	
	(1)	(2)	(3)	(4)
	ln(weekly wages)	ln(daily wages)	ln(weekly wages)	ln(daily wages)
parameter estimates				
Co-op (C)	-0.078 (0.019)	-0.095 (0.018)	0.028 (0.026)	0.015 (0.026)
user cost of capital (r)	-0.011 (0.012)	-0.001 (0.011)	-0.011 (0.010)	0.009 (0.010)
(user cost of capital)*Co-op	0.107 (0.084)	0.110 (0.079)	-0.110 (0.084)	-0.113 (0.086)
fixed costs (F)	-0.004 (0.001)	-0.004 (0.001)	0.005 (0.002)	-0.002 (0.002)
(fixed costs)* Co-op	-0.363 (0.099)	-0.247 (0.093)	-0.502 (0.074)	-0.463 (0.075)
product market shock (S)	0.037 (0.003)	0.017 (0.003)	0.052 (0.002)	0.029 (0.002)
(product market shock) * Co-op	0.032 (0.024)	0.045 (0.022)	0.052 (0.019)	0.078 (0.019)
implied effects				
capitalist-coop log wage differential	-0.164 (0.028)	-0.146 (0.026)	-0.140 (0.028)	-0.141 (0.028)
$\partial \ln w / \partial r$: capitalist firms	-0.011 (0.012)	-0.001 (0.011)	-0.011 (0.010)	0.009 (0.010)
$\partial \ln w / \partial r$: co-ops	0.096 (0.083)	0.110 (0.078)	-0.120 (0.084)	-0.104 (0.085)
$\partial \ln w / \partial F$: capitalist firms	-0.004 (0.001)	-0.004 (0.001)	0.005 (0.002)	-0.002 (0.002)
$\partial \ln w / \partial F$: co-ops	-0.367 (0.099)	-0.252 (0.093)	-0.498 (0.074)	-0.465 (0.075)
$\partial \ln w / \partial S$: capitalist firms	0.037 (0.003)	0.017 (0.003)	0.052 (0.002)	0.029 (0.002)
$\partial \ln w / \partial S$: co-ops	0.068 (0.024)	0.062 (0.022)	0.103 (0.019)	0.107 (0.019)

Notes to Table 5:

Estimated standard errors are in parentheses beneath their estimated coefficients. In addition to the variables listed above, the equations are estimated including the following variables: age, age squared, gender, two regional variables (distinguishing the North, Center, and South), three industry variables (distinguishing manufacturing, construction, retail trade, and other industries), two occupation variables (distinguishing operatives, clerical workers, and managers), the logarithm of employment (to allow for any company size effects on wages), and dummy variables for each calendar year. The capitalist-coop log wage differential is evaluated at the overall mean values for r , F , and S , namely, $r = 0.188$, $F = 0.298$, and $S = 0.044$. These equations use 137,682 observations.

Table 6 - Instrumental Variable Estimates of the Employment and Capital Equations

	dependent variable	
	(A)	(B)
	<i>ln(employment)</i>	<i>ln(capital)</i>
right-hand side variables		
<i>ln w</i>	-0.803 (0.032) [0.0080]	-0.200 (0.067) [0.0081]
<i>(ln w).C</i>	0.819 (0.136) [0.0178]	0.879 (0.269) [0.0212]
<i>r</i>	-0.094 (0.009)	-0.386 (0.019)
<i>r.C</i>	0.086 (0.108)	0.036 (0.237)
<i>F</i>	0.136 (0.032)	0.456 (0.067)
<i>F.C</i>	0.054 (0.201)	0.011 (0.424)
<i>S</i>	0.383 (0.003)	0.201 (0.008)
<i>S.C</i>	-0.118 (0.036)	-0.012 (0.074)
Sargan test	5.636 (2) [0.060]	3.341 (2) [0.188]

These equations are fitted in first difference form. Entries in parentheses are estimated standard errors. Numbers in square brackets represent partial R^2 statistics from the first stage regression equation (which addresses the predictive power of the excluded instruments). In the case of the Sargan (over-identification) test, we report the value of the statistic, the degrees of freedom (in parentheses), and the p-value of the test [in square brackets]. Regional, industry, and calendar year dummy variables are each statistically significant at the one percent level. The employment equation is fitted to 95,240 observations and the capital equation to 95,129 observations. (Some firms report no capital and these observations are not included when fitting the capital equation.)

Table 7
 Implied Elasticities of Employment and of Capital with respect to Wages,
 the User Cost of Capital, Fixed Costs, and the Product Market Shock

		employment		capital	
		(A)	(B)	(C)	(D)
elasticity of employment or capital with respect to:	evaluated at the.....	capitalist enterprises	co-op enterprises	capitalist enterprises	co-op enterprises
wages	mean	-0.803 (0.032)	0.017 (0.133)	-0.200 (0.067)	0.679 (0.262)
	median	-0.803 (0.032)	0.017 (0.133)	-0.200 (0.067)	0.679 (0.262)
user cost of capital	mean	-0.019 (0.002)	-0.002 (0.022)	-0.076 (0.004)	-0.070 (0.047)
	median	-0.018 (0.002)	-0.002 (0.020)	-0.072 (0.004)	-0.065 (0.044)
fixed costs	mean	0.0007 (0.0002)	0.0017 (0.0018)	0.0024 (0.0004)	0.0043 (0.0038)
	median	0.0006 (0.0001)	0.0002 (0.0002)	0.0002 (0.00003)	0.0004 (0.0004)
product market shock	mean	0.383 (0.003)	0.265 (0.036)	0.201 (0.008)	0.189 (0.073)
	median	0.383 (0.003)	0.265 (0.036)	0.201 (0.008)	0.189 (0.073)

Notes to Table 7:

The entries next to “mean” present elasticities evaluated at the sample mean values of the variables distinguishing the capitalist enterprises mean from the co-op enterprises mean. A similar definition applies to “median” elasticities. An alternative way of presenting elasticities is to compute the elasticities for each firm and then calculate the mean and median values of these implied elasticities. In fact, these average and median elasticities were close to those reported above.

Table 8

Least-Squares Estimates of the Co-ops' Input Demand Functions

	<i>ln(employment)</i>	<i>ln(capital)</i>
right-hand side variables		
<i>r</i>	0.061 (0.186)	-0.478 (0.212)
<i>F</i>	0.316 (0.373)	0.434 (0.423)
<i>S</i>	0.503 (0.035)	0.409 (0.040)
R ²	0.205	0.140
nobs	975	969

Notes to Table 8:

Estimated standard errors are in parentheses beneath their estimated coefficients.

Figure 1
Employment Differences between a Capitalist Firm and a Co-op

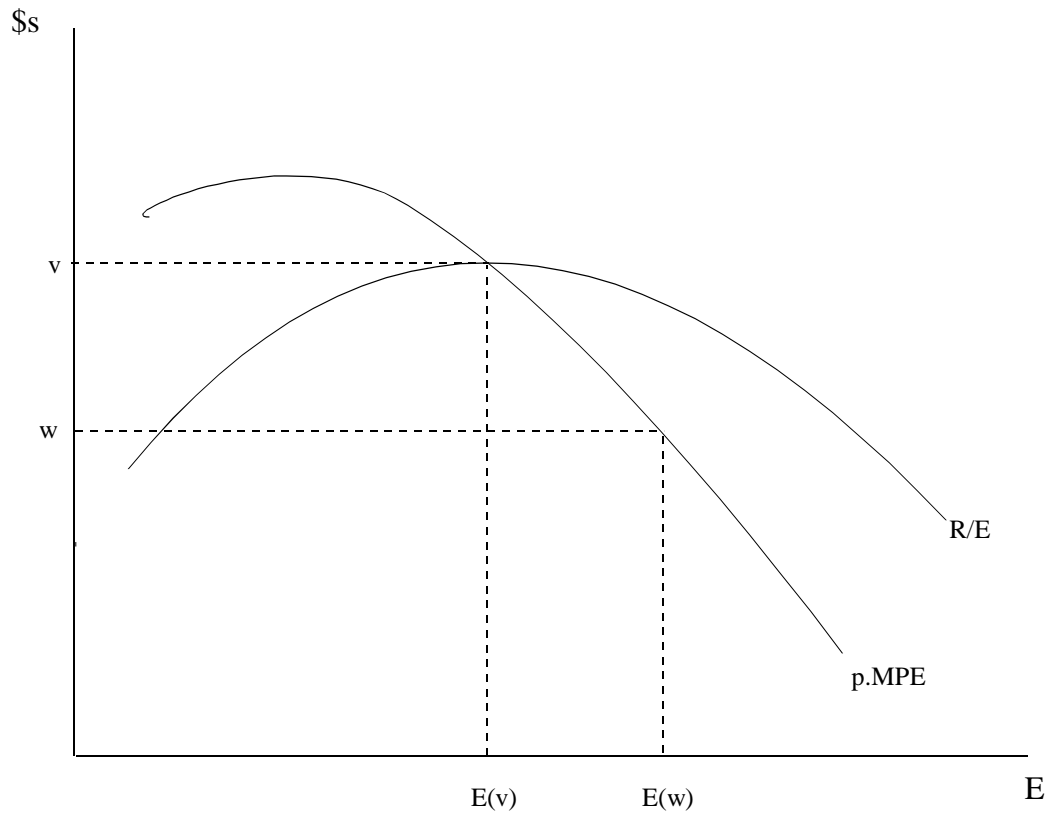


Figure 2
Employment and Earnings in a Co-op Constrained by a Labor Supply Function

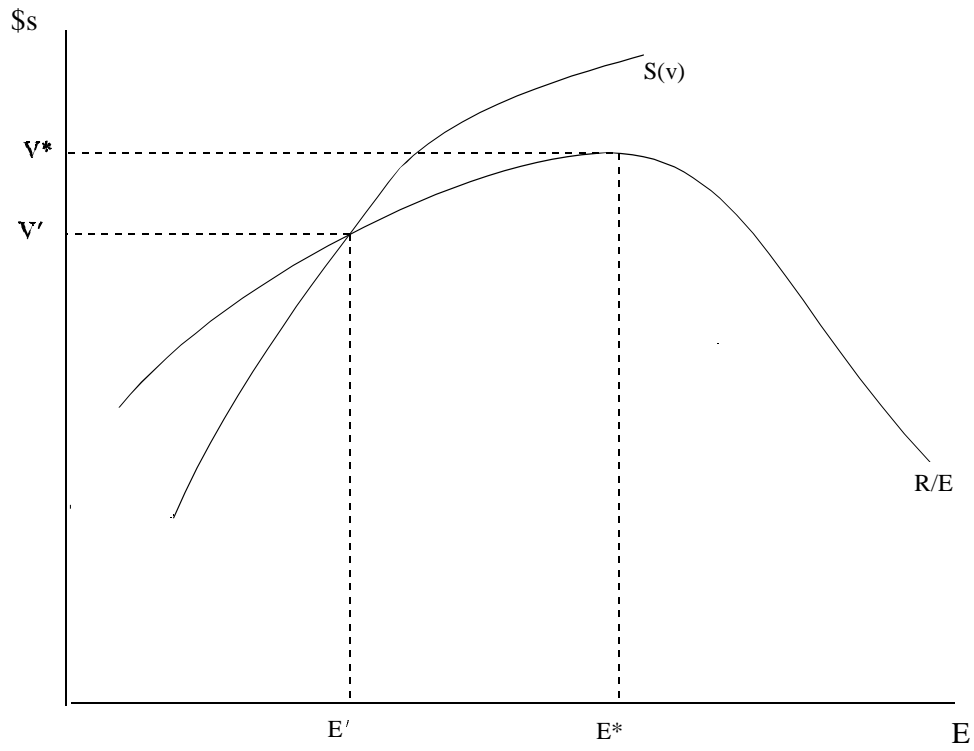
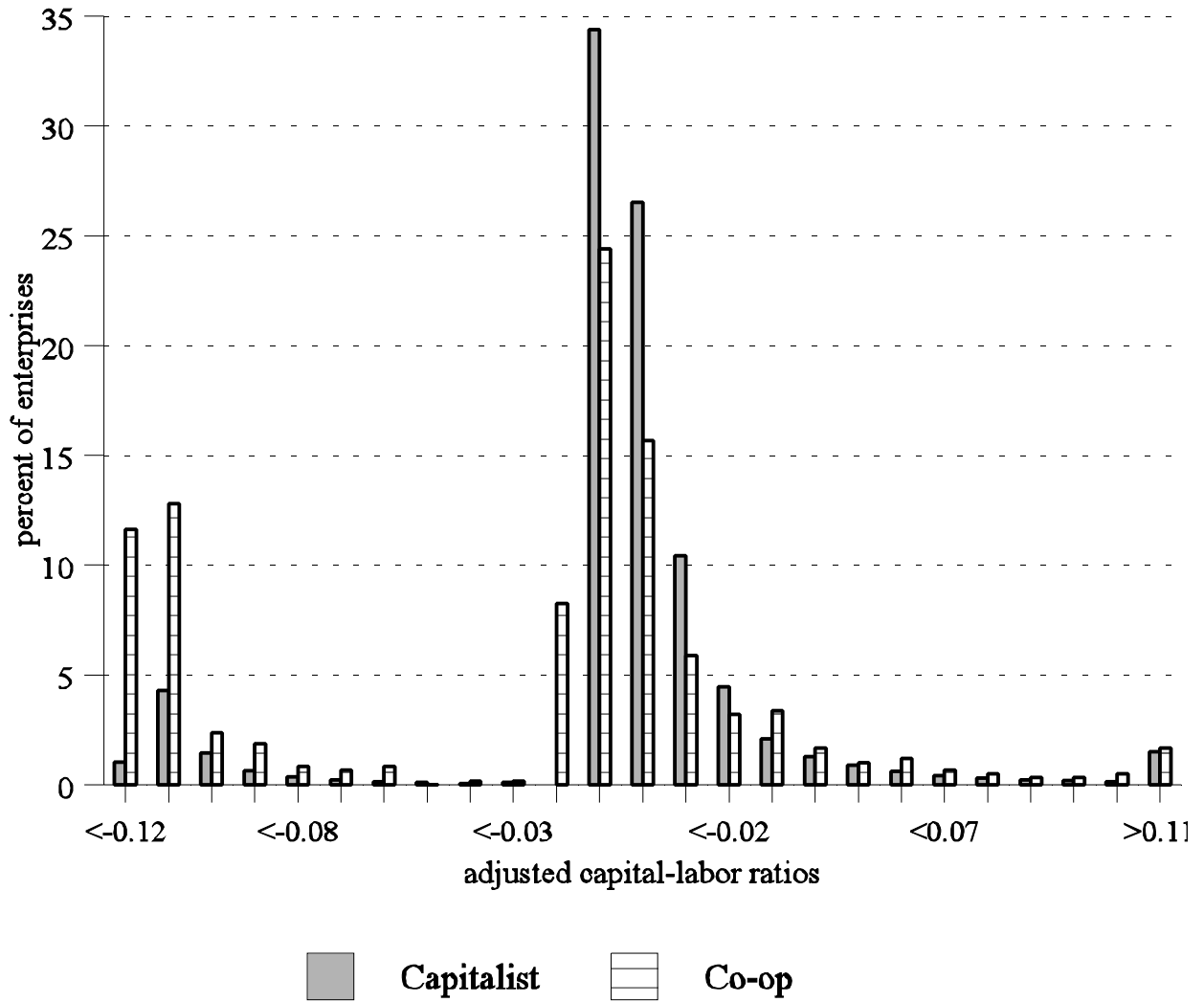


Figure 3

Frequency Distribution of Capital-Labor Ratios for Capitalist and Co-op Enterprises



The horizontal axis corresponds to deviations in capital-labor ratios from their industry mean values. The categories represent intervals of 0.01 (so “<-0.08” contains observations between -0.09 and -0.08.) The lowest category is ≤ -0.12 and the highest category > 0.11 .