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Apprenticeship Contracts and Credit Markets in Ghana

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The shortage of skilled manpower is broadly considered to be a severe constraint on economic development in Africa. The past two decades have seen a dramatic expansion of educational systems throughout the continent (see Psacharopolous and Woodhall, 1985, and Knight & Sabot, 1990), many of which have included the establishment of government vocational and technical schools. While the expansion of primary and academic secondary education is expected to have an impact on overall labor productivity, as well as on health, political participation and other social goods, vocational education is geared toward the development of specific industrial skills. The fields in which the schools are established, and the numbers of students who are accepted and trained, are often decided in conjunction with national manpower planning efforts.

In many African countries, this expansion of vocational training has occurred alongside a traditional system of vocational training in the form of apprenticeship. African apprenticeship systems generally exist outside the formal educational system, with little interaction with vocational schools and neither control by nor intervention from government. While a great deal has been written about the expansion of formal education in Africa, with particular attention on evaluating the impact of education on productivity, earnings, inequality, and growth, (see Collier and Lal, 1986, and Knight and Sabot, 1990) little is known about the role of apprenticeship in generating human capital for the manufacturing sector, or about the influence of apprenticeship on earnings. Steel (1979) notes the widespread existence of apprenticeship training in Ghana, voicing concern about the ability of manufacturing to absorb these workers, but does not discuss the institution itself in detail. Without an examination of this institution, it is impossible to generate a coherent picture of the nature and extent of skill formation within manufacturing, or to assess the role this form of training could play in improving productivity or expanding the manufacturing sector.

In addition, analysis of apprenticeship systems allows us to extend our understanding of the nature of contracting behavior in manufacturing sectors and of African economic institutions more generally. The institution itself, and the relationship between firms and apprentices imbedded in it, potentially provide insight into the way manufacturing firms are organized and operate, and their mechanisms for overcoming the constraints imposed by market failures in a variety of arenas. Although there is a small literature in education and anthropology focusing on the structure and educational content of individual firms' apprenticeship programs, the economics literature includes no systematic quantitative portrait

of either the prevalence and scope of apprenticeship in manufacturing or the microeconomic details of the contracts involved. The growing literature on economic institutions in developing countries provides strong additional motivation for this work.

This paper takes a first step in creating such a descriptive portrait and beginning an institutional analysis by reporting findings from a 1992 survey of 185 manufacturing firms in Ghana. The report highlights three major findings. First, the training of apprentices is a widespread activity among manufacturing firms in Ghana, and apprenticeship training is part of the background of a large fraction of entrepreneurs and manufacturing workers. Apprentices, and former apprentices, are, however, concentrated in the small end of the size spectrum. A broad quantitative description of the incidence of apprenticeship is presented in Section II.

Second, there are two primary types of apprenticeship contracts apparent in the data, differentiated by their use of apprenticeship fees. A description of these contracting forms and their importance is presented in Section III.

Third, for those firms training apprentices, the choice of contract type appears to be strongly correlated with other characteristics of the firm, particularly its use of credit. An analytical framework for the examination of contract choice is provided in Section IV, while Section V presents an attempt to evaluate the implications of this framework using the Ghanaian data.

As background for the discussions of the prevalence and structure of apprenticeship contracts in Sections II, III,IV and V, the paper begins with a description of the data and the study from which it is drawn, presented in Section I. Finally, Section VI presents a summary and, most important, raises some questions for future research in this area.

1. The Data

The data used in this study are drawn from a survey of 185 manufacturing firms in Ghana conducted in the summer of 1992. The survey is part of the Regional Program on Enterprise Development (RPED), a multi-year study of the manufacturing sector in several African countries (Cameroon, Côte d'Ivoire, Ghana, Kenya, Rwanda, Burundi, Tanzania, Zambia and Zimbabwe). The RPED is organized by the African Technical Division of the World Bank,

and funded by a number of European and the Canadian governments. The field work for the Ghana study was conducted by a team of researchers from the Centre for the Study of African Economies at Oxford University and the Department of Economics at the University of Legon in Ghana.

The RPED is designed to provide an overview of the performance of manufacturing firms in the post structural adjustment period for these economies, and focuses on a wide variety of areas of firm behavior. The survey instrument, which was administered to the firm owners or managers, includes modules covering: the history of the firm; current production and sales; the personal history of the entrepreneur; labor force structure, wages and apprenticeship contracts; use and adaptation of technology; firm response to the regulatory environment; and experience with conflict and conflict resolution. The instrument also includes a survey for a sample of each firm's workers and apprentices, which yielded an additional sample of 545 workers and 212 apprentices. This paper uses data drawn from almost all of the modules, and hence allows for an examination of apprenticeship contracts within the context of a broad range of firm characteristics and activities.

The sample was drawn from four manufacturing sectors: food and beverage processing, woodworking and furniture, textiles and garments, and metal working.[1] The final sample of 185 firms used in this paper included 42 in food, 54 in wood working and furniture, 41 in textiles and garments, and 48 in metal working. The sample included firms from across the size spectrum. Forty of the firms are micro enterprises with fewer than 5 workers, 81 are small firms having 5 to 29 workers, 39 are medium sized in the 30 to 99 worker range, and 25 are large enterprises with more than 100 workers. The firms represent the full spectrum of ownership structure, ranging from individually owned small enterprises to subsidiaries of multinational corporations and parastatal operations.

[1] Details about the sampling frame and sample construction are available in Baah-Nuakoh & Teal (1993).

2. Apprenticeship: Prevalence & Concentration

The quantitative importance of apprenticeship in the manufacturing sector can be measured in three dimensions: the fraction of current entrepreneurs who were trained as apprentices, the fraction of workers in the sub-sample who were trained as apprentices, and the fraction of firms which are currently training apprentices. All three of these measures point to a number of conclusions.

First, apprenticeship is fairly widespread in Ghanaian manufacturing. Of the 151 individual entrepreneurs interviewed in the survey (managers of multinational enterprises, parastatals, and other corporate entities were omitted from this module), 82, or 56%, had been apprentices. Most (74%) had done their training in the field in which they were currently in business. Of the 545 workers in the sample, 45% had been trained as apprentices. Finally, 97 of the firms, or 52%, were training apprentices at the time of the survey.

Second, apprenticeship training is most important in the small firms, as seen in Table 1 below.

Table 1:
Apprenticeship and Firm Size

Firm Size (# of workers)	% of Entrepreneurs who were apprentices	% of Workers who were apprentices	% of firms training apprentices
Micro (< 5)	54	37	37
Small (5 - 29)	66	57	72
Medium (30 - 99)	30	43	38
Large (100 +)	9	30	36

The concentration of apprenticeship in small firms is also evidenced by the fact that firms owned by former apprentices are smaller, and were smaller at the time of their founding, than are firms owned by individuals who were not apprentices. Former apprentices account for 62% of owners of firms with fewer than 30 workers, but only 23% of owners of firms with more than 30. The mean current size of firms owned by former apprentices is 14 workers, and the mean size at the time of founding of these firms was 8 workers. The mean size of non-apprentice owned firms is 58 workers, having been an average of 38 workers at founding.

Similarly, the mean size of firms in which apprentices are trained is 33, while the mean size of firms not training apprentices is 77. This does not mean, however, that apprenticeship is not found in the larger firms, since Table 1 indicates that 36% of the large firms in the sample were training apprentices. As we shall see in Section III, however, the nature of the apprenticeship programs in large firms differs substantially from that found in the smaller firms.

Third, apprenticeship training is least important in the food sector, but of similar importance in each of the other three sectors, as seen in Table 2.

Table 2:
Apprenticeship and Sector

Sector	% of Entrepreneurs who were apprentices	% of Workers who were apprentices	% of Firms training apprentices
Food	20	21	17
Textiles	69	46	56
Wood	59	53	68
Metal	55	54	62

The relative unimportance of apprenticeship in the food sector is driven in part by the size distribution of firms in this sector. Forty-eight percent of food firms are either large enterprises or micro enterprises, the sizes in which apprenticeship is least common. In addition, however, only 16.7% of the *small* firms in the food sector employ apprentices. This is probably due to the low level of skills required by food processing activities (most of the firms are either micro bakeries or large automated beverage processors), which is also evidenced by the fact that in those food firms where apprentices are trained, the mean duration of the training is less than half the mean duration of training in other sectors.

Fourth, entrepreneurs who were themselves trained as apprentices are nearly twice as likely to train apprentices as are owners who were not. Thirty-eight percent of the owners who were not apprentices were training apprentices at the time of the survey, compared with 74% of owners who were apprentices. Unsurprisingly, apprenticeship training is passed from generation to generation. Apprenticeship is widely considered to be training for self-employment, and that impression is borne out in these data as well.

Although apprenticeship is a widespread practice, particularly among small firms, it is not a single undifferentiated institution. Details about the variety of apprenticeship contracts offered in Ghanaian manufacturing are presented in the next section.

3. Apprenticeship Contracts

Apprenticeship is a form of skill acquisition in the context of production, or on-the-job training. The apprentice, in addition to learning his trade, provides labor services to the firm. The apprentice/firm relationship, therefore, includes two types of transactions, one being the provision of labor services by the apprentice to the firm, the other being the provision of training services by the firm to the apprentice. The relative importance of these two components may vary over the course of the apprenticeship, as the value of the apprentice's labor rises as he accumulates human capital. The dual nature of this relationship has important implications for the structure of the financial relationship between the firm and the apprentice.

The two facets of the apprentice/firm relationship give rise to two components of the financial relationship between apprentices and firms. Taken separately, the provision of labor services by apprentices would give rise to payments of wages by firms, while the provision of training services by firms would give rise to payments of fees or tuition by apprentices. In the context of an apprenticeship relationship, in which both these exchanges are taking place, the actual financial relationship between master and apprentice becomes more complex.

In a simple model, we might expect that the labor services and training services would be exchange directly, and payments made only when the values of the two services are unequal, so that monetary flows between the two parties would be the net value of the compensation due to the apprentice for his labor minus that due to the firm for the training. In this case, then, we would see three kinds of arrangements: payments by firms to apprentices when the value of labor services exceeds the value of training, payments by apprentices to firms when the value of training exceeds the value of labor services, and no payments of either type when the values of the labor and training services are equal. This approach to understanding the financial arrangements surrounding apprenticeship is clearly described in Coy(1989).

In reality, however, the monetary arrangements surrounding apprenticeship training in Ghanaian manufacturing are more complex. First, in addition to wage payments, many apprentices receive allowances for food, housing, clothing, or transportation. These payments are made both in cash and in kind, but are identified by firms as distinct from wage payments. In larger firms, these allowances are paid to all workers, and have been used as a way to generate non-taxable compensation. The government recently passed a compensation consolidation act, so that allowances will not be paid separately from wages in the future. In smaller firms, allowances are often paid even when wages are not. Historically, apprentices often lived with their masters during training, and while this practice has largely died out, provision of basic living expenses by the master continues to be a common feature of these contracts. In the following analysis, these allowances will be included in apprentice earnings as payments by firms to apprentices, though we will measure them separately when possible.

Second, and more important, we also see contracts in which apprentices both pay fees to the firm and receive wages and/or living allowances in return. In total, then, there are four types of apprenticeship contracts offered by the 97 firms in the sample which trained apprentices in 1992. The characteristics of these contracts, their relative importance in the sample, and some characteristics of the individuals and firms engaged in them are presented in the Table 3.

The evidence in the table illustrates several important features of the pattern of apprenticeship contracts. First, the dominant contract forms, types 2 and 3, involve payments of wages or living allowances. The clear distinction between contract types is around the payment of fees rather than the payment of wages and allowances. The significance of this distinction will be explored in the next two sections.

Table 3:
Apprenticeship Contracts

	Type 1	Type 2	Type 3	Type 4
Fee Charged	No	No	Yes	Yes
Apprentices Paid	No	Yes	Yes	No
Number of Firms	6	34	41	16
Share of Firms (%)	6	35	43	16
Number of Food Firms	1	4	0	2
Number of Textile Firms	3	1	10	9
Number of Wood Firms	0	15	19	3
Number of Metal Firms	2	14	12	2
Mean Firm Size (# workers and apprentices)	42	49	13	12
Mean monthly earnings of apprentices (cedis)	0	13302	5542	0
Mean monthly wages of apprentices (cedis)	0	9650	2579	0
Mean monthly allowances of apprentices (cedis)	0	3695	2645	0
Percent of firms paying allowance but not wages	-	6	58	-
Mean total apprenticeship fee (cash + Kind)	0	0	33985	35100
Mean cash fee paid at start of apprenticeship	0	0	17037	28125
Mean cash fee paid at end of apprenticeship	0	0	8536	4062
Mean kind fee paid at start of apprenticeship	0	0	3087	1275
Mean kind fee paid at end of apprenticeship	0	0	4090	1637
Mean duration of apprenticeship in years	1.7	2.2	2.9	2.6
Mean age of apprentices	17	22	21	23
Mean years of aducation of apprentices	11	11	10	11
Mean share of workers who are female (%)	50	5	12	73

Second, both contract types in which apprentices are not paid, types 1 and 4, are dominated by textile firms, and these are also the contract forms in which there is a high concentration of female apprentices. In many of these seamstress operations,the apprentices not only pay initial fees and provide their own sewing machines, they also pay monthly tuition. In essence, these firms operate largely as schools where young women spend the period between formal education and marriage, and the training of apprentices is a significant source of revenue for these entrepreneurs.[2]

Third, although textile firms are more likely to charge apprentices fees than are firms in other sectors, the practice is not limited to these firms. A significant fraction of both wood and metal firms also charge apprenticeship fees. This implies that a discussion of contracting

[2] Several of these young women told me that their dressmaking apprenticeship was a form of dowry, selected and paid for by their fathers, since these marketable skills would make them more attractive potential wives.

behavior is more than an examination of sector-specific institutions, and must be driven by factors that are common across sectors.

Fourth, firms that charge fees are substantially smaller than firms that do not. Apprenticeship fees are part of a training institution which seems to be unique to the "informal" sector. The basic characteristics of this institution as it exists in both West and East Africa, including the payment of fees, the provision of living allowances, and the marking of the end of training with a party hosted by the apprentice, have been described elsewhere in the economics (Berry 1985, Bas 1989), education (King 1977) and anthropology (Coy 1989) literatures. All of these authors have described the institutions in some detail, and their work shows that the basic characteristics are very similar across countries.

None of the authors, however, have attempted to explain why these "traditional" apprenticeship programs are structured as they are, though each has identified one characteristic as particularly salient. King focuses on the fact that under such arrangements in both Kenya and Nigeria "apprentices pay for their training." Berry, in a discussion of apprenticeship among mechanics in Nigeria, where wages are not provided but living allowances are, states that "Although apprentices were not very skilled or efficient, the fact that they did not have to be paid was crucial in a trade where receipts are likely to be irregular and working capital is therefore implicitly expensive." (p. 142) Although neither statement is fully accurate for our sample, both reflect a significant factor driving the structure of apprenticeship contracts in small-scale manufacturing. An analytical approach to understanding apprenticeship contracts incorporating these ideas is presented in the next section.

4. Human Capital Theory

Since apprenticeship is a particular form of on-the-job training, apprenticeship contracts can be analyzed using basic human capital theory, following the discussion of training in Becker (1975). Begin the analysis with the assumptions that labor and training markets are competitive and capital markets are perfect, so that the cost of training, which is also the returns received by the firm for providing it, is exactly equal to the present value of the

stream of returns generated by the training. Given that framework, some simple theory provides a mechanism for understanding the apprenticeship contracts described above.

Assume that training takes place in period 0, after which time the apprentice is qualified in his trade, and works for one period. The training entails a cost, C, which includes the time spent by the master and other employees in working with the apprentice. During the training period, the apprentice's productivity is MP_0, which is the marginal product of an unskilled worker in this firm or outside. Once the training is completed, the apprentice's productivity rises to MP_1 if he stays in the firm, and MP_1^* if he goes to work elsewhere. The assumption of competitive markets implies that $C = (MP_1 - MP_0)/(1 + r)$, where r is the one period interest rate.

The relationship of the apprentice's productivities inside and outside the firm provides a measure of the degree of firm-specificity of the training. Define an index of firm specificity, a, as:

$$a = (MP_1^* - MP_0)/(MP_1 - MP_0)$$

Fully specific training, which raises the apprentice's productivity only if he stays in the firm, is equivalent to a=0. Fully general training, which is as productive in other firms as it is in the firm providing it, corresponds to a=1. Intermediate cases can be indexed by values of a between zero and one.

The more specific the training provided, the larger the share of the returns to that training which can be captured by firms, and the greater the share of the cost of providing that training will firms be willing to bear. The apprentice will bear a share of the cost of his training which is exactly proportional to the degree of specificity of that training, so his cost is aC, where $0<=a<=1$.

To the extent that the training is firm-specific, the employer will wish to induce the worker to stay so that it can capture the returns to its portion of the investment. Since the worker bears none of the cost of this type of training, and will reap none of the returns, his wage in the post training period will be the same in this firm and outside, and he has no incentive to stay with the firm. Providing an incentive to stay can be accomplished by altering the timing of payments, paying lower wages during the training period and higher wages in the post-training period. While such a strategy should leave the worker's welfare

unchanged, it will provide him with the incentive to stay with the firm after training is completed. The nature of this adjustment for the firm's share of training costs will not depend in any clear way on payment strategy, but will apply to the specific portion of training under all the strategies discussed below.

The share of training costs borne by the apprentice is not, however, the only potential determinant of contract form. Although the apprentice will ultimately bear the costs of aC, there are a number of strategies that can be used to pay these costs, and these payment strategies will give rise to different contract forms. The strategies can be characterized along two dimensions: payment form and payment timing. Payments can take two forms, being either deductions from wages or direct payments to masters. Payments may be made before, during or after the training. Payments made before the training may be thought of as "apprentice financing" of training, payments made during training are "pay as you go financing," while payments made after training occur in the context of "employer financing." While these payment strategies can occur in combination, it is useful to begin by describing them independently.

The most straightforward strategy is for apprentices to pay the full amount of their training cost through deductions from wages during the training period. Under this strategy, apprentices would receive
$W_0 = MP_0 - aC$ during the training period. Once training is completed, the worker receives $W_1 = MP_0 + a(MP_1 - MP_0)$ if he stays with the firm and $W_1^* = MP_1^*$ if he leaves the firm and works elsewhere. Given the definition of a, $W_1 = W_1^*$. If $MP_0 - aC >= 0$, this type of financing arrangement is consistent with contract types 1 and 2, in which no fees are paid and zero or positive wages are received during training. If $MP_0 - aC < 0$, we would see a contract in which wages are zero and fees are paid on a continuous basis during training. This would be a variant of contract type 4, with no fee before training, but fees paid during. Although we do observe a few firms charging monthly fees, they also charge fees at the beginning of training, so a contract involving only pay as you go fees is not observed in these data.

A second strategy is for the apprentice to finance the training before it begins. If the worker finances the full amount of the training in this manner, he pays a fee of $F = aC/(1+r)$ at the beginning of period 0, and receives a wage of $W_0 = MP_0$ during the training period. In the second period he receives $W_1 = MP_0 + a(MP_1 - MP_0)$ if he stays with the firm and W_1^*

$= MP_1^*$ if he leaves the firm. This strategy is possible even if $MP_0 - aC < 0$ and would be manifested as contract type 3, in which both fees and wages during training are positive.

Apprentices may also choose to finance only part of their training in advance, paying for the rest through deductions from wages during the training period. In that case the apprentice pays a fee of
$F < aC/(1+r)$ before training begins and receives wages of $W_0 = MP_0 - aC + F$ during training. His post-training wages will be the same as in the three strategies described above. This strategy is consistent with both contract types 3 and 4, where 4 is a special case in which $MP_0 - aC + F = 0$.

Alternatively, the apprentice's share of training costs may be paid after training through deductions from wages, so that the firm actually finances the training. In the extreme case, the apprentice would bear none of the costs during training, receiving a wage of $W_0 = MP_0$ during the training period. At the end of training the apprentice would owe the firm $aC(1+r)$, which would be paid as a deduction from his wage in the post-training period, which would then be $W_1 = MP_0$. In an intermediate cases in which the apprentice bears part of the cost during training, he receives $W_0 > MP_0 - aC$ but less than MP_0 during training, at the end of which time he owes the firm $[aC - (MP_0 - W_0)](1+r)$. Repayment through wage deductions in the post-training period yields $W_1 = MP_0 + (1+r)(MP_0 - W_0)$. The second term reflects the fact that the worker receives the return on that fraction of the cost of training he actually paid through wage deduction during the training period. This wage is less than the $MP_0 + a(MP_1 - MP_0)$ which he would have received if he financed the training himself. Employer financing of training, where no fees are paid, is consistent with contract types 1 and 2.

Unlike "pay as you go" arrangements, which contain no credit components, both apprentice and employer financing arrangements give rise to moral hazard issues. In the case of apprentice financing, the fact that some or all of the costs of training are paid by the apprentice in advance provides an incentive for the firm to either fail to provide training or to discharge the apprentice before the training is completed. The larger the fraction of the costs paid in advance rather than during training, the more severe this problem becomes. One mechanism for dealing with this problem is for the apprentice to defer payment of part of the fee to the end of the training period. Forty percent of the firms that charge defer some of the cash portion of their fees to the end of the training, deferring an average of 20% of fees to the end. The end of apprenticeship is often celebrated by a party hosted by the apprentice.

The party marks a change in status for the apprentice, indicating his freedom from the bonds of apprenticeship and his entry into the community of craftsmen. Guests at the party include relatives, friends, and business associates of the apprentice and the master. While some of the end fees seen in the data may be used to finance the party, the data do not allow us to identify party costs separately. A second enforcement mechanism is the owner's desire to maintain his reputation. While owners are not engaging in repeated contracts with any individual apprentice, they will need to continue to attract apprentices, and this reputation effect may act to limit the moral hazard problem. In these data, older firms are less likely to have deferred fees in their contracts, as are firms in which apprentices are a larger fraction of their labor forces, indicating that reputation factors may be an alternative to deferred fees.

Under employer financing, the wage the apprentice receives from the firm in the post-training period is less than what he would receive if he left the firm. This creates a problem of moral hazard on the part of the apprentice, who has an incentive to borrow the training costs from the firm, and then leave without paying them back.[3] There are three obvious possible mechanisms the firm could use to ensure that the worker remains with the firm in the post-training period. The first is to require apprentices to post a performance bond at the beginning of the training period, which will be refunded once the worker's debt has been paid off. While this is possible, it seems unlikely, since an apprentice who could post a bond large enough to cover his debt would therefore also be able to pay that amount as a fee, thereby financing that part of his training himself. A second type of bonding scheme is through deferred compensation. Under this mechanism, workers are paid lower wages during the training period and higher wages during the post-training period. By deferring some of the compensation to the later period, the firm induces the apprentice to stay. This mechanism would be indistinguishable in practice from mechanisms to encourage workers to stay in order for firms to have access to the returns to their investments in specific human capital.

A third mechanism for dealing with both types of moral hazard described above is the use of binding written agreements generating an indenture or bonding of the apprentice to the master while also defining the master's obligations. External enforcement of these agreements

[3] It should be noted that this is different from the firm having financed investment in specific human capital and wishing to retain the worker in order to appropriate the returns. In that case, the worker has not borrowed from the firm, and the worker's earnings would not be enhanced by leaving, so there is no real problem of moral hazard. Under employer financing of general human capital, the worker can actually benefit from leaving before his debt is repaid.

may be provided by the legal system, trade unions, or crafts associations. Nearly half of the firms in the sample have unionized labor forces or belong to trade associations which set explicit rules governing apprenticeship. Many more firms may belong to associations which settle disputes for their members. Finally, 85% of the apprentices in the sample had found their masters through the recommendations of friends or relatives, and these social networks will also act as an external means of enforcing contractual obligations. The parties and rituals surrounding apprenticeship serve to reinforce these social networks, and therefore aid in contract enforcement.

Apprenticeship contracts can be written to combine several of these financing strategies, so that the apprentice may finance part of the training as initial fees, part through deductions from wages, and part through lower wages in the post-training period. Although the characteristics of contracts can be observed, the combination of strategies underlying each contract cannot be. It is therefore not possible to distinguish strategies by looking at the contracts themselves, since some contracts can be consistent with more than one financing strategy.

We can, however, describe the circumstances under which each strategy might be expected to be chosen, and attempt to relate these circumstances to observed contract types. This will allow us to generate some hypotheses which can then be examined by a closer look at the data. This exercise in hypothesis formation and testing is contained in the following section.

5. The Determinants of Contract Choice

There are two categories of factors which should influence the choice of payment strategy, and hence the choice of contract type. The first category includes characteristics of the training itself, while the second set includes characteristics of the firm and the apprentice. As was shown in Table 3, the educational and age characteristics of apprentices do not differ significantly across contract types, but other apprentice characteristics may. On the firm side, it was obvious in Table 3 that firms offering contract types 3 and 4 are significantly smaller than firms offering contract types 1 and 2. Small size in and of itself, however, is not a characteristic which should influence the choice of contract type. Firm size is endogenous,

and determined by a number of other factors which may also influence the choice of contract type. A principal task of the rest of this analysis will be to identify factors which, although they may be correlated with size, are more reasonable causes of differences in firm behavior.

The foregoing discussion of payment strategies indicated that an arrangement which does not involve payment of fees by apprentices (contract types 1 and 2) can be generated both by strategies in which workers pay the full cost of training through wage deductions during the training period and strategies involving employer financing of part of the cost. This implies that the only clear distinction between strategies which can be made through an examination of contract types is between those which involve some worker financing through fee payments (contract types 3 and 4) and those which do not (contract types 1 and 2). The bulk of the discussion, therefore, will focus on the determinants of the use of apprentice financing.

With this caveat in mind, characteristics of the training itself should exert an influence on the selection of payment strategies and therefore on contract type. The more specific the training, the lower the cost of training that will be borne by the worker. This would make it easier for workers to finance the training costs out of wage deductions during the training period, as in contract types 1 and 2. More specific training would also give rise to the development of wage profiles designed to induce workers to remain with the firm once training is completed, which is also true of employer financing of the apprentice's share of the costs, another explanation of contract types 1 and 2. We would therefore expect that contract types 1 and 2 would, on average, involve a greater fraction of specific training. Although the dataset does not contain information about the content of apprenticeship training, we can use information about the behavior of apprentices post training to proxy for specificity. The more specific the training, the greater the probability that the apprentice will continue working for the firm after training. And if specificity lowers costs and increases the likelihood that workers finance training through deductions from wages during the training period, we would expect to see contract types 1 and 2, in which no fees are paid, to be associated with larger fractions of apprentices staying on. The dataset provides three mechanisms for making this comparison, and the relevant data are presented in Table 4.

Table 4:
Specific Training and Contract Type

	Fee Paid	No Fee Paid
Mean share of apprentices finishing training last year who stayed on at the firm	20%	76%
Mean share of current apprentices surveyed who plan to stay on when training is completed	12%	50%
Share of surveyed workers currently working in the firm in which they did apprenticeship who paid a fee for that apprenticeship	28%	
Share of surveyed workers currently working in firms other than that in which they did apprenticeship who paid a fee for that apprenticeship	55%	

It seems clear from the above data that firms which do not charge their apprentices offer more specific training than do firms in which apprentice fees are paid. It should be noted that decisions about the type of training to offer and the financing strategies involved may be made simultaneously, A firm offering more specific training will bear a larger fraction of the costs, and the ability to do so may be driven by the same factors determining the firm's use of employer financing of the worker's share of costs.[4]

Before turning to a discussion of the firm characteristics influencing the use of worker financing, it is useful to present some evidence about the validity of interpreting apprentice fees as worker financing. The cost of training includes both time and equipment. In these data, firms that charge fees are more than three times as likely to require their apprentices to provide their own tools than are firms which do not charge. In providing their own tools,

[4] A second characteristic of training one would expect to be relevant to contract choice is total training costs. In particular, lower training costs make it more likely that the apprentice can pay for his share through deductions from wages during the training period. There is no clear association, however, between the level of training costs and the choice between apprentice and employer financing. Once costs are too high to be borne easily as wage deductions, there is no obvious reason to expect apprentice or employer financing to be more likely.

Similarly, the duration of training, which might affect costs, is also influenced by financing decisions. Employer financing requires that the apprentice stay on after training is completed, and would give rise to longer measured apprenticeships for any given training costs. While Table 3 indicates that apprenticeships in which fees are charged are of longer average duration, this could be due to a number of factors, including the more general nature of the training they provide, and cannot be clearly related to costs.

these apprentices are financing the capital costs of their training. This type of behavior is consistent with the idea that apprenticeship financing is a reasonable way to think about these contracts.

Since the choice of contract type is based on a decision about the financing of training, it should depend on the access of firms and apprentices to funds. Apprentice financing of training is a form of informal credit from apprentices to firms, and we would expect to see apprentices finance their own training when they have access to funds at a lower interest rate than that available to firms, or where they are able to access more funds than can firms. This is the idea that Berry reflected in her discussion of the expense of working capital to these firms. The decision to charge apprentices depends on a firm's access to working capital relative to that of the apprentice, and firms in which fees are charged would be those for whom funds to finance the training are more scarce or more expensive.

Although a firm's access to or cost of financing cannot be measured, their behavior in other arenas involving financing can be used as an indicator. If the hypothesis above is correct, firms that charge apprenticeship fees will differ from firms that do not in terms of their use of alternative sources of finance, their relationships with other business partners, and their behavior and experience in credit markets generally. In particular, we would expect that firms which charge fees to their apprentices would differ from other firms in their mechanisms for obtaining working capital. This is not direct evidence of credit constraints, but rather indicates that the factors driving financing arrangements in apprenticeship may also influence other aspects of behavior.

Data about several features of firms' credit and financial market behavior are presented in Table 5 below. The table is divided into several sub-sections. The first deals with the role of borrowing in financing startup and capital acquisition costs. The second deals with contractual relationships with suppliers. Firms were asked to describe the form of payment (cash, credit, or advance payment) they used with the primary suppliers of their three major raw materials, and then to give the details of the last transaction of each type they conducted. Each firm can engage in all three types of transactions. A firm is said to receive supplier credit if any of its principal raw materials suppliers extends credit. The table presents two characteristics of supplier credit for those firms receiving it. The first is the mean value of the elapsed time between delivery of the goods and final payment, and the second is the implicit interest rate paid for the credit, measured in terms of the cash discount foregone.

The third section of the table deals with contractual relations with customers. Again, the firms were asked to describe the form of payment they used with their most important customers, or that they used most frequently, in the case where they had a large number of infrequent customers. They were also asked to describe the details of their most recent transaction of each type.

The fourth section includes data about relationships with the banking sector. A firm is considered to have received bank credit if it had either a loan or an overdraft facility at a bank or other formal financial institution in the last three years. They were also asked if they had applied for a bank loan in the last year, and if they had ever applied. Finally, they were asked if they currently held demand or time deposits at a bank or other formal financial institution.

The fifth section deals with informal credit. Firms were asked if they had borrowed money on the informal credit market (this includes loans from friends, relatives, suppliers, clients, other enterprises and informal moneylenders) in the past three years. They were also asked if they had participated in any informal savings groups, or had used the services of a money keeper, who is an individual who holds cash for safekeeping in exchange for a fee.

The data in the table indicate the following. Firms that charge for apprenticeship financed a larger share of their startup out of personal and family resources than did firms that do not charge. There was, however, no significant difference in their use of borrowing to finance subsequent capital acquisitions. It should be noted, however, that in the sample as a whole, including firms with no use of apprentices, the share of capital acquisitions financed by borrowing is generally very low, due primarily to the poor condition of the Ghanaian banking system in the 1980's.

Second, while firms that charge their apprentices were no less likely to have received credit from suppliers than were firms that did not charge, they did get shorter repayment periods and pay higher interest rates, in terms of foregone cash discounts, than did the other firms. They were also more likely to be dealing with their suppliers on a cash basis, perhaps because some suppliers were unwilling to extend credit, or because the firm did not wish to accept it at the terms offered.

Table 5:
Contract Type and Firm Credit Market Behavior

	Type 1	Type 2	Type 3	Type 4
1. Financing of Startup and Capital Equipment Purchases				
Share of Startup financed by borrowing (%) *	25	24	5	25
Share of startup financed by own or family resources (%) *	75	73	93	75
Share of most recent capital acquisition financed by borrowing (%)	18	20	9	21
2. Relations with Suppliers				
Share of firms receiving credit from input suppliers (%)	33	35	32	19
Mean length of supplier credit for those receiving it (days) **	45	51	29	9
Mean implied interest on supplier credit for those receiving it (%) **	7	4	13	10
Share of firms paying cash to input suppliers (%) **	100	76	93	93
Share of firms making advance payments to suppliers (%)	0	11	2	0
3. Relations with Customers				
Share of firms making sales on cash basis (%) **	50	38	66	75
Share of firms making sales on credit basis (%) **	67	62	27	44
Share of firms receiving advance payment from customers (%) **	50	44	68	56
4. Relations with Banking Sector				
Share of firms receiving bank loans (%)	16	6	0	6
Share if firms receive overdraft facilities (%) **	33	17	7	6
Share of firms holding bank accounts (%) *	100	79	63	75
Share of firms applying for a bank loan in the past year (%)	25	19	19	12
Share of firms that have ever applied for a bank loan (%)	33	50	36	25
5. Informal Credit Markets				
Share of firms receiving informal credit (%) **	33	26	51	44
Share of firms using informal safekeeping services (%) **	0	4	18	19
Share of firms participating in informal savings groups (%)	0	3	7	0

* indicates that a t-test for a difference in means between firms that charge and those that do not is significant at a 10% level.
** indicates the test is significant at a 5% level.

Third, firms charging apprenticeship fees were more likely to deal in cash or advance payment with their clients, and less likely to extend them credit. This is consistent with the idea that these firms are short of working capital, and therefore less able to finance production in advance of sale. Since the elapsed time between order and delivery of goods is far less than the mean duration of apprenticeship, it seems reasonable to conclude that firms which do not finance their production costs out of working capital would be unlikely to finance training.

Fourth, these firms are less involved with the banking sector, both as borrowers and as depositors, than are firms offering the other form of contract. This is particularly true of firms offering contract type 4, most of which not only did not receive loans, but did not apply for them. The difference across contract types in the fraction of firms receiving loans is larger than the difference in the fraction applying for loans, indicating a higher rate of loan denial for firms charging apprenticeship fees.

Finally, firms that charge fees are more likely to be involved in the informal credit market, both as borrowers and as users of safekeeping services. What is not clear, however, is whether they choose informal banking because the formal sector is inaccessible, or whether they elect not to participate in formal banking transactions because they are satisfied with the options available in the informal market. Worker financing of training is itself a source of informal credit. The evidence indicates that firms which are more likely to use informal credit use several forms of informal credit, including borrowing from their customers in the form of advance payment, and borrowing from their apprentices in the form of advance fees. Contract choice in apprenticeship markets, then, seems to mimic financing choices in other arenas, and to be part of an overall financing strategy emphasizing informal credit arrangements.

The relationship between these credit market behaviors and apprenticeship contract choice is summarized in Table 6, which presents the results of a probit estimation of the influence of such capital market features on the probability that a firm charges a fee to apprentices. The dependent variable takes the value 1 if the firm charges a fee. The independent variables include sectoral dummies, firm size, and the share of startup financing provided by own or family resources, followed by a series of dummy variables which take the value 1 if: the firm made sales on a cash basis, made sales on a credit basis, made sales

with advance payment, received bank credit, held bank accounts, received informal credit, and used informal safekeeping services.

There is substantial correlation among the independent variables, particularly those related to banking and informal credit, resulting in imprecise estimates. Given that difficulty, the results indicate that, even holding firm size constant, there is a relationship between credit market behavior and the use of apprenticeship fees. In particular, firms that do not provide financing to their customers are less likely to provide financing to apprentices. Use of the formal banking sector is negatively correlated, while use of informal credit markets is positively correlated, with charging apprentice fees. It must be emphasized, however, that this shows only correlation, not causation. Both credit market behavior and contract choice would be influenced by factors that control the firm's access to and cost of funds. The probit provides results consistent with the notion that worker financing of apprenticeship results from poor firm access to working capital, but is not a test of that hypothesis.

Table 6:
Probit Estimates of the Decision to Charge Apprentice Fees

Dependent Variable=CHARGE=1 if the firm charges a fee

N=96
Chi2(13) = 65.57 Pseudo R2 = .5036
Log-Likelihood = -32.3657

	Coefficient	**T-Ratio**
Food sector dummy	-0.0505	-0.573
Wood sector dummy	-0.360	-0.696
Metal sector dummy	-1.371**	-2.440
Firm size	-0.031**	-2.205
Share of startup self financed	0.009*	1.659
Firm makes sales on cash basis	0.848**	2.139
Firm makes sales on credit basis	-1.012**	-2.465
Firm makes sales with advance payment	0.913**	2.090
Firm received bank credit	-0.472	-0.762
Firm hold bank account	-0.636	-1.361
Firm recieved informal credit	0.188	0.501
Firm used informal safekeeping	1.302**	1.859
Constant	-1.208551	-2.251

* indicates coefficent signigicant at 10% level
** indicates coefficient significant at 5% level

Finally, in order for apprentices to finance their training, they must have access to funds. Most apprentice fees are paid by parents, and many apprentices have little knowledge of the specifics of the arrangements that were made. If parents are the main source of funds for apprentices, then one would expect that apprentices for whom fees were paid are more able to draw on parental resources. The survey of apprentices included questions about financial relationships with parents, and while not all firms were represented, the results are interesting and presented in Table 7 below. This evidence indicates that apprentices in contracts involving fees do have better access to parental financing.

Table 7:
Apprentice Relations with Parents

	Fee Paid	No Fee Paid
Share of apprentices receiving money from parents	87%	57%
Share of apprentices sending remittances to parents	12%	42%

Overall, the evidence indicates that contract choice in apprenticeship, insofar as it is based in decisions about the financing of training, is influenced by the relative access to funds of firms and apprentices. In contexts such as manufacturing in Ghana, where firms are small and informal and not necessarily clearly distinguishable from households, it seems reasonable that some firms would be unable to finance training as easily as their apprentices can.

6. Summary and Directions for Future Research

The first section of this paper indicates that there is a great deal of training taking place on the job in the manufacturing sector in Ghana, particularly in small firms. While this paper does not explore the content of this training, and therefore cannot assess its quality, it seems clear that the training of a new generation of craftsmen is an important part of economic activity in the small-scale manufacturing sector. Equally important, the evidence indicates that these firms provide relatively general training, generating skills which are useful in other

firms and which seem to provide apprentices with preparation for entrepreneurship. Both King and Berry note that apprenticeship in a trade is a route to self-employment, and the importance of apprenticeship training in the backgrounds of the entrepreneurs in this sample supports this idea. The important implication of this fact is that apprenticeship should not be excluded from general analyses of vocational training in Ghana, and that the human capital being generated in small scale manufacturing should be considered when policy in this area is made.

The human capital approach taken here provides insights into the quotations from King and Berry presented in Section III. While King's contention that apprentices pay for their training is correct, since all apprentices ultimately bear the cost of the general portion of their training, what is truly interesting about fee-paid apprenticeships is that they involve apprentice financing as well. Berry's contention that the usefulness of apprentices to firms is that they do not have to be paid is insightful in its focus on the importance of working capital constraints in motivating the structure of apprenticeship contracts.[5] This paper has expanded their ideas by looking more closely at the financing arrangements involved in apprenticeship contracts.

Finally, the discussion suggests one more avenue through which the functioning of credit markets may influence economic behavior. The correlation between apprenticeship contract choice and other credit market behavior, while it neither shows causation nor identifies the root cause of differences in these behaviors across firms, does indicate that the practice of firm financing of training is related to the way in which firms finance other activities. This implies that changes in the functioning of urban capital markets could influence patterns of human capital formation in addition to their more well known effects on technological change, employment, and growth.

This analysis has provided a first step in understanding the role of apprenticeship in manufacturing in Ghana. It does, however, neglect some important questions including the determinants of the firm's decision to train apprentices and to offer general or specific

[5] While these contract forms do alleviate working capital constraints, it is unlikely that the fact that apprentices do not receive wages actually increases firm profits. The small payments received by apprentices would be exactly offset by their low productivity. Only if apprentices received less than their productivity minus training costs would this practice actually enhance firm profits. This would only be possible if the firm charged the apprentices more than their training cost, which they could only do if they had some market power. Given the large number of small firms engaged in the training of apprentices in any trade, this kind of market power seems unlikely.

training, and the influence of apprenticeship training on the employment opportunities, career paths, and wages of apprentices. Future work must address these issues. In an era of budgetary crisis and structural adjustment forcing many African countries to reduce their education budgets, the role of alternative training institutions such as apprenticeship must be explored.

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