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Credit, Incentives, and Reputation: A Hedonic Analysis of Contractual Wage Profiles

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A hedonic analysis of principal-agent employment contracts is developed in which workers and employers exchange labor services and contractual payment patterns. Within this framework, tests of alternative hypotheses are formulated and applied to contract data from a unique household-level survey of economic activity in rural China in 1935. The results indicate that credit market constraints motivated workers' and employers' contract choices, that shirking by workers rather than by employers was the dominant incentive issue, that reputational concerns rather than threats of termination were the key worker-disciplining device, and, finally, that the contract's third party acted as an enforcement device rather than as a matchmaker. Subject to the availability of matched agent-principal data, this structural approach to modeling agency relationships can also be used in contemporary settings.

I. Introduction

In the principal-agent relationship, one party, called the agent, agrees to supply services to or perform activities on behalf of the other, called the principal. This relationship is complicated because the parties have opposing interests and some payoff-relevant information or action is hidden. Client, shareholder, employer, landowner, and franchisor constitute only a short list of possible principals.

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The literature on principal-agent problems is substantial though largely theoretical (Hart and Holmstrom 1987; Sappington 1991). The objective of the theoretical research is to provide mappings from assumptions concerning market structure and the parties' preferences, endowments, production, and information technologies and market access to efficient contracts. In contrast, empirical studies of agency relationships try to draw inferences about these primitives from contracts and payments. Beginning with a sample of contracts or payments, empirical studies ask one or more of the following questions: Are the principals, the agents, or both constrained in the credit or insurance markets? Do the parties have private payoff-relevant information or have the opportunity to take payoff-relevant actions that are hidden from each other? Are all contract terms explicit and observed by the researcher? Are contracts enforced by the court or through some other means?

In some settings, the answers to a number of these questions will be obvious and uninteresting. In others, however, and more generally, these questions are difficult to answer because the parameters of an optimal contract depend on the attributes of both parties, but detailed and matched data on principals and agents are rarely available.[1] As a result, empirical research on principal-agent problems has been limited in volume and scope. Employer-employee contracts, which are the concern of this paper, have been examined by Lazear and Moore (1984), Hutchens (1986), Leonard (1987), and Krueger (1991). The first tnree papers test whether or not payment patterns are consistent with an underlying worker incentive problem, and the last one presupposes a worker incentive problem and tests whether or not payment patterns are consistent with workers' having limited abilities to post bonds.

In this paper we develop and estimate a structural principal-agent model of employment contracts. Our data are drawn from a unique household-level survey of economic activity during 1935 in a large number of rural villages in China (Guowuyuan shiyebu linshi chanye diaochaju 1936). These data and the economies they describe are especially interesting for two reasons. First, since every household in a village was surveyed and each employment contract in a village identifies the parties to the contract and their households, the survey provides matched worker-employer data for a cross-section of independent economies (villages). Second, since the credit and insurance markets and the legal environment in these economies in 1935 were

[1] Additionally, discriminating between hidden action and information problems is difficult with data on one party because these problems presuppose private information and can have similar contractual implications.

relatively primitive, every one of the questions posed earlier has a potentially interesting answer.

The contracts in our sample differ in length and payment pattern. The sequence of payments associated with each contract is summarized by two measures: one describing the overall level of wages and the other describing the shape of the wage profile. The model we propose to explain the joint determination of these two contract variables is a hedonic pricing model (Rosen 1974, 1986). In the context of this model, the wage profile shape prescribed by a contract is an important "job attribute" that is itself priced in the market. This model and its empirical implementation consist of three equations: a worker demand equation for wage profile shapes, an employer supply equation for wage profile shapes, and a market equilibrium wage equation expressing a contract's wage level as a function of its wage profile shape and attributes of the worker and the local economy. Alternative hypotheses concerning the determinants of contract parameters have distinct implications for demand and supply that can be formulated and tested within this framework.

Many different models have been proposed to explain multiperiod contractual payment patterns. As we are concerned with 1–12 month employment contracts in a rural village setting, it seems a priori unlikely that wage profiles were designed to encourage investment in human capital (Becker 1964; Hashimoto 1981), to insure workers with initially uncertain productivities (Harris and Holmstrom 1982), or to sort workers to increase productivity (Salop and Salop 1976; Guasch and Weiss 1982). Furthermore, these alternative models of deferred compensation cannot account for negatively sloped wage profiles. In our sample, 62 percent of the contracts have negatively sloped wage profiles, and of these, 45 percent had only a single payment made at the very beginning of the contract.

In this paper we focus attention on two nonexclusive possible determinants of payment patterns: capital market constraints and job-related incentive problems. Even within this credit incentives framework, the range of competing hypotheses remains large. First, consider a situation in which effort is observable and fixed but workers (and their households) have only limited access to the credit market. In this case, a downward-sloping wage profile becomes a device for providing a short-term loan from an employer to a worker. Now consider a situation in which it is difficult to monitor worker effort and employers offer contracts specifying noncontingent wages and termination clauses that commit them to firing workers who are caught shirking (Becker and Stigler 1974; Lazear 1981). In this second case, an upward-sloping wage profile discourages shirking because a worker who shirks and is caught and fired will lose the wage

premium at the end of the contract. When credit and incentive problems are both present, a trade-off in the design of contracts results that is exactly analogous to the basic insurance incentives trade-off in atemporal principal-agent problems (Hart and Holmstrom 1987).

Credit and incentive problems need not be specific to workers. When employers are credit constrained, an upward-sloping profile can be a means of providing a loan from a worker to an employer. Alternatively, suppose that employers can engage in malfeasance by, say, arbitrarily changing working conditions during employment. In this case, a downward-sloping profile postpones profits and thus discourages this behavior to the extent that public revelation allows workers to quit without costs. A credit incentives trade-off in contract design may therefore exist on the employer side as well. Of course, credit and incentive issues can be important without necessarily implying any such trade-off. Contracts struck in environments in which workers are restricted in the credit market but employers may engage in malfeasance, or vice versa, have this feature. A trade-off may also be absent if there are future reputational costs to parties when malfeasance is publicly revealed. If these costs are large enough, a threat to fire or quit may be unnecessary as a disciplining device (MacLeod and Malcomson 1988; Gibbons and Murphy 1992). Without the threat of termination, however, noncontingent wage profiles have no incentive effects and can be chosen on the basis of credit considerations alone.

Our hedonic model of wage profiles allows us to test these various competing hypotheses by identifying their distinct implications for an individual worker's and employer's contract choices. While an analysis of household-level decision making and of households' employment contract portfolios could also uncover credit problems, incentive problems are specific to employment relationships and can be tackled only when the contract rather than the household is the unit of observation.

When the structural hedonic approach is used, distinct credit, reputation, and hence incentive influences on contractual wage profiles are confirmed for our sample of rural labor contracts. We provide econometric evidence showing that a worker's marginal bid price and an employer's marginal offer price for a contract's wage profile each respond to changes in the wage profile and in their respective household asset endowments in a manner consistent with the view that participants on both sides of the labor market had limited access to the credit market. We also show that these marginal bid and offer prices are influenced by the presence of a third party to the contract and by the availability of a contracting partner from the same village in a manner indicating that an incentive problem was present in em-

ployment, with workers being the primary source of this problem; that implicit termination contracts were not especially important; that the role of a third party to a contract was as a device for disciplining malfeasance; and that employers were in part motivated to hire workers from inside their own villages because of the greater difficulty of distinguishing high- and low-productivity workers from other places.

Section II introduces the data and provides a brief description of the distinguishing features of rural employment contracts in China in the 1930s. Section III sketches the hedonic modeling approach. Section IV describes how wage levels and profiles are measured. Section V provides a theoretical examination of the determinants of wage profiles with a view toward formulating testable hypotheses. Section VI describes the econometric specification of the hedonic model. Our main findings are reported in Sections VII and VIII.

II. The Data

The data examined in this paper were the product of an extensive household-level survey that was carried out in 1936 by the government in what is now Northeast China (Manchuria).[2] This survey provides a rich and detailed description of economic life, from January through December of 1935, in 21 separate villages. Each of these villages was effectively a small open economy, with goods and services flowing between that village and its neighbors. Summary information was also compiled for each surveyed village on economic conditions in the local economy, that is, in four to six of its outlying villages. Since the local economies corresponding to surveyed villages i and j are geographically and economically independent, we effectively have observations on a cross section of 21 separate economies.

Every household in each surveyed village was enumerated. Altogether, 1,049 households are described; the number of households per village ranges from 24 to 91. The survey includes data on family demographic structure, farm output, input use, assets, incomes, and expenditures, as well as detailed information on all credit, land, and labor contracts involving villagers. In this paper we restrict attention to the labor market and, specifically, to a sample of employment contracts with durations ranging from 1 to 12 months. These "long-term"

[2] This government had been installed by Japan. Conflict between China and Japan in the early 1930s resulted in the takeover of Manchuria by Japan in 1932. The survey in question was administered by the First Section of the Provisional Industrial Investigation Bureau in the Ministry of Enterprises of the National Affairs Yuan of Manchukuo, which was formed several years prior to 1936 with a mandate to gather data on rural social and economic conditions for the purpose of making rural policy. Previous research using these survey data is largely descriptive (Myers 1976).

non–spot contracts were the predominant type of employment contract in the surveyed villages.[3] The 1,049 households in our sample were engaged in a total of 750 long-term employment contracts; complete contract data are available for 583.[4] The information described in each labor contract is listed in the Appendix.

Rosen (1986) observes that a basic problem for empirical studies of compensating differentials has been the difficulty of matching personal and establishment data; in most studies, detailed data are available for either workers or firms but not both. In this context, a remarkable feature of the Chinese contract data is that detailed household-level information is available for both parties for most contracts; among 583 contracts, household-level information is available for the worker (employer) in 326 (419) cases.[5]

As to data quality, it is known that the Japanese and Chinese investigators charged with data collection worked with local village officials and elite to obtain the cooperation of households in the survey (Myers 1976). An argument can nevertheless be made that a fear of taxes or expropriation may have induced respondents to underreport their incomes and assets. Whether significant underreporting was possible in villages that typically had fewer than 50 households remains an open question. We proceed to take the data at face value, noting that our analysis is immune to consistent underreporting (whence all respondents underreport the same variable to the same degree).

A. *Ex Ante versus Ex Post Values*

A single sequence of wage payments is recorded for each contract in our sample. Thus, for any contract, it is possible that the payments recorded by the surveyors may be different from the payments originally agreed on between the contracting parties. Consider the following scenario: A worker accepts a contract specifying a sequence of wage payments. During the course of the contract, the employer experiences a negative revenue or positive cost shock. As a result, the

[3] These 1–12-month contracts covered about 91 percent of the farm labor hired in, 80 percent of farm labor hired out, and 92 percent of nonfarm labor hired out. Nonfarm employment was located primarily outside the surveyed villages; i.e., most villagers employed as nonfarm workers were employed elsewhere.

[4] Some households in the sample were engaged in more than one labor contract whereas others had none. The latter households chose either spot contracts or some nonmarket activity.

[5] More specifically, household-level information is available for every worker and employer residing in one of the surveyed villages: in the case of 162 contracts, the worker and employer were from the same surveyed village; in 164 cases, the worker alone was from one of the surveyed villages (the employer and the job were located in an outlying village); and in 257 cases, the employer alone was from one of the surveyed villages (the worker resided elsewhere).

original contract is renegotiated and the worker agrees to reduced payments for the remaining contract. Since our data do not identify which, if any, labor contracts were renegotiated, we cannot determine whether or not the ex post payments were the same as those prescribed by the ex ante contract and, if they differ, whether or not the surveyors recorded the ex ante or ex post values.

The distinction between promised and realized wages is important because our economic model and hence our econometric model are meant to describe workers' and employers' motives for choosing among ex ante contracts. In cases in which the recorded wage pattern describes the wages that were actually paid and in which payments toward the end of the contract are lower than those initially agreed on, we would ascribe a lower average wage level and a flatter wage profile to these contracts than are appropriate. This potential bias in recorded employment contract data is not unique to the present study. In our case, however, we believe that it is unlikely to be important since we cannot find compelling evidence of a difference between recorded wage payments and ex ante values that is consistent with widespread employer-initiated reductions. This observation is of independent interest since it suggests that labor markets may differ from other factor markets in low-income rural village economies in the sense that the rate of total or partial default of employers is low compared to that of land tenants and explicit borrowers.

The manner in which non–labor contract data are reported in the survey leads us to believe that the reported wage payments were likely prescribed ex ante and honored in full. By all indications, the surveyors were extremely thorough in recording the terms of primarily verbal contracts. The land rental contracts, for example, provide information on both the ex ante rent negotiated in January or February and the actual ex post rental payment in September or October, at the time of the harvest. Cases in which the ex post rent is less than the ex ante rent are explicitly identified, as are cases in which an unpaid tenant balance was converted into a debt contract. The credit contracts likewise distinguish borrowers who are meeting prescribed payments from those whose payments are in arrears; these contracts include all loans made in 1935 as well as any outstanding loans from previous years dating back to the early 1920s. The fact that ex ante–ex post distinctions are *not* made in the reporting of wage payments and are made in the reporting of rent and loan payments suggests that ex ante wage agreements were respected in full.

Quantitative evidence is also available to support the view that our contract data describe ex ante wage payments (see Brandt and Hosios 1994). It is interesting that the same evidence does not imply that workers were unconcerned with the possibility of ex post wage reduc-

tions. After all, in models in which employers design contracts to mitigate shirking, it can turn out that, in equilibrium, workers do not actually shirk. Thus, to determine whether or not workers were concerned with the possibility of ex post wage reductions, we should model this situation and test its predictions. Our earlier paper extends the credit incentive model of wage profiles developed later in Section V to allow for this possibility.[6] As the distinguishing predictions of this version of the model are rejected by the data, it appears that the workers described in our data were not especially concerned with the possibility of unexpected contract renegotiation.

B. Rural Labor Contracts

The data reveal substantial variation in the length and timing of employment contracts and in the shape of their wage profiles. A brief description of these contracts and of households' beginning-of-period asset positions follows below. Since the contracts in our sample were mostly verbal agreements between the parties in question, it is appropriate to begin with a discussion of contract enforcement.

The local practices and procedures that historically governed private contractual exchange in rural China are commonly referred to as "customary law" (Chen and Myers 1976, 1978). China had no civil code that was uniformly administered in the countryside through a local judiciary, and so in key respects the implicit law embodied in these practices and procedures was similar to a civil law. The legality of these local practices was tacitly recognized by the government; up through the early twentieth century there are known cases in which government officials adjudicated disputes on the basis of the customs that governed such agreements locally. By and large, however, the view of a succession of Chinese governments was that contract enforcement was a private matter and that contracts were to be executed by the parties to the contract, possibly with the aid of a third party so identified in the contract. Enforcement costs were thus borne by individuals and not the state.[7]

We now turn to the data. Table 1 describes the distribution of contracts by length and starting date. Figure 1 describes the aggregate

[6] The idea is simply that workers will prefer payments shifted toward the beginning of a contract when contracting with employers who are constrained in the credit market because constrained employers are more likely to default on end-of-contract wage payments in some states of nature.

[7] With the establishment of Manchukuo by a puppet Japanese regime in Northeast China in 1931, a civil code may have been adopted; the literature does not say. Regardless, it is reasonable to assume that in the rural villages we examine, contract enforcement continued to be carried out in the context of customary law.

TABLE 1

DISTRIBUTION OF CONTRACTS BY LENGTH AND STARTING DATE

LENGTH (Months)	Starting Date				TOTAL
	January–March	April–June	July–September	October–December	
1–3	12	16	54	24	106
4–6	85	12	40	0	137
7–9	82	3	1	0	86
10–12	254	0	0	0	254
Total	433	31	95	24	583

employment generated by contracts of different lengths. Several features are noteworthy: First, all but one contract began and ended in 1935;[8] in the 7–9-month contract category, one contract began during July–September and hence ended some time in early 1936. Second, and subject to this proviso, the contracts that start at any given time of year have every possible duration. In March, for example, we observe contracts starting with lengths between 1 and 10 months. Third, most contracts started during the first or third quarter, or just prior to the spring planting and fall harvesting periods. And fourth, the relatively large number of 1–6-month contracts undermines the conventional view that agricultural workers in low-income countries are hired primarily on a daily basis or for intervals that span entire crop periods and longer.

Table 2 describes the distribution of contracts by length and wage pattern. Not surprisingly, the proportion of contracts with intermittent payments increases with contract length. Still, among the 7–12-month contracts, the proportion of contracts with a single payment at only one end remains relatively high. Indeed, the range of wage profiles among contracts here is much greater than that generally associated with modern labor markets; in the latter case, a positively sloped payment profile is the norm.[9]

Table 3 provides a breakdown of our contract sample in terms of the relationship between the contracting parties. For each contract,

[8] The survey makes clear that a contract identified as, say, a 3-month contract starting on January 1 was in fact a 3-month contract, and not simply the last three months of a contract that started some time prior to 1935. Even in the case of a worker and an employer who had worked together prior to 1935, the survey associates the period of employment during 1935 with a contract covering only that period; e.g., a worker employed during March–April of 1934 and 1935 by the same employer is viewed here to have been employed on two 2-month contracts instead of a 14-month contract with a 10-month break.

[9] Some notable contemporary exceptions are sign-up bonuses and book advances.

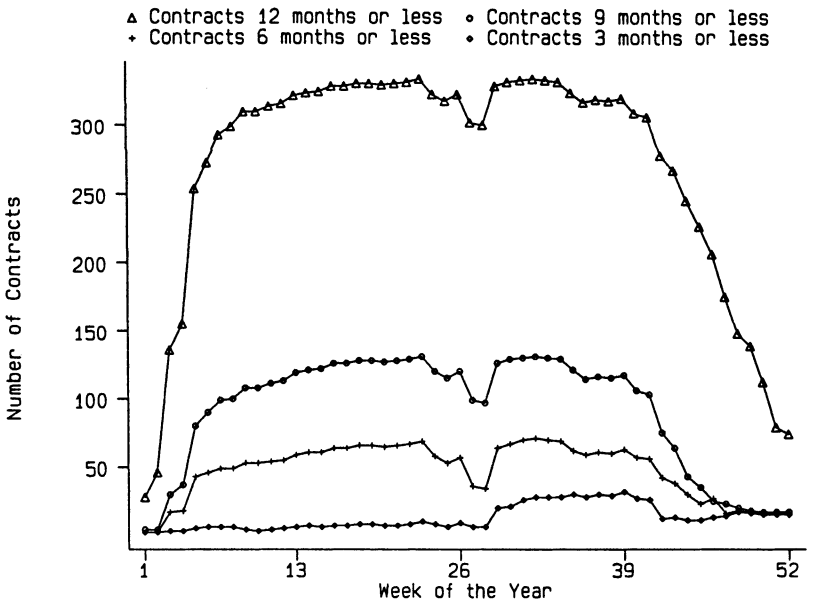


FIG. 1.—Aggregate employment by contract length

it is known whether the employer and worker were relatives, whether they resided in the same village, and whether there was a third party to the contract. Third parties were typically widely known and respected individuals, though their exact role is unclear and is not described in the survey. Different explanations for these patterns of trading partners are examined later. Two features in table 3 are noteworthy: First, a large fraction of the contracts between residents of the same village are also contracts between relatives. This may reflect the fact that a nonnegligible fraction of the households in these small

TABLE 2

DISTRIBUTION OF CONTRACTS BY LENGTH AND PAYMENT PATTERN

Contract Duration (Months)	Paid at Beginning	Paid in Between	Paid at End	Total
1–3	32	49	25	106
4–6	54	73	10	137
7–9	24	52	10	86
10–12	52	168	34	254
Total	162	342	79	583

NOTE.—Contracts are classified "paid at beginning (end)" if a single wage payment is made within 10 days of the start (end) date of the contract. In the intermediate case, several payments, usually of unequal amounts, were paid over the duration of the contract.

TABLE 3

RELATIONSHIPS BETWEEN CONTRACTING PARTIES

All Contracts	Related	Both Villagers	Third Party
Related	156	72	9
Both villagers		161	13
Third party			104

rural villages are members of the same (extended) family.[10] Second, for the most part, contracts with a third party involve workers who are employed outside of their own villages, where they are less likely to be known.

Table 4 describes the number and proportion of contracts, by payment pattern, within each relationship category.[11] When payment patterns are compared, the proportion of contracts involving a third party tends to increase as payments are shifted toward the beginning of the contract. The same pattern is observed among contracts with a third party whether or not the contracting parties are also from the same village. Contracts between parties residing in the same village are a slightly higher proportion of those with only a single payment at either end of the contract.

Table 5 describes the mean asset holdings and initial credit positions of workers' and employers' households in 1935. Overall, the distribution of assets among workers' households is more dispersed and less informative. Nevertheless, for employment contracts in which a single payment is made at the beginning, the average asset positions of the contracting parties are consistent with the view that an up-front payment is, in part, a loan from the employer. These employees' households were endowed, on average, with considerably less land, fewer draft animals, and fewer farm implements than the households of workers whose contracts entail any other payment pattern. On the other hand, their average accumulated debt was actually lower than that of others at the beginning of 1935. In the case of employers who offered labor contracts in which a single payment is made at the beginning, their households had significantly larger landholdings than those offering contracts with deferred payments and were larger net creditors at the beginning of 1935.

[10] Of the 1,049 households in the survey, 530 were related (through males) to one or more other households residing in the same village.

[11] For example, 35 percent of the contracts in which a single payment was made at the very beginning were made between relatives. Because the relationship categories are not mutually exclusive, the proportions do not sum to one.

TABLE 4

PAYMENT PATTERN BY RELATIONSHIP OF PARTIES

Relationship of Parties	Paid at Beginning	Paid in Installments	Paid at End
Relatives	56 (.35)	83 (.24)	17 (.22)
Reside in same village	53 (.33)	79 (.23)	29 (.35)
Third party	47 (.29)	52 (.15)	5 (.06)
None of the above	48 (.29)	169 (.50)	37 (.47)

NOTE.—The numbers in parentheses are the proportion of contracts of each payment type that are between relatives, villagers, etc. The numbers do not add to one because in some contracts, e.g., the parties both reside in the same village and are related to each other.

TABLE 5

MEAN ASSET HOLDINGS FOR EMPLOYEES AND EMPLOYERS BY PAYMENT PATTERN

	Paid at Beginning	Paid in Between	Paid at End
Number of contracts	162	342	79
Employee assets:			
Number of households	107	162	56
Land owned	6.22	18.23	17.21
	(17.86)	(65.18)	(59.47)
Draft animals	.18	.46	.54
	(.51)	(1.10)	(1.28)
Farm implements	.53	.87	.79
	(1.38)	(2.18)	(2.14)
Dependents	2.31.	2.25	2.23
	(2.28)	(1.69)	(1.97)
Indebtedness at beginning of year	−5.84	20.86	19.02
	(105.00)	(104.63)	(71.75)
Employer assets:			
Number of households	108	258	52
Land owned	545.01	484.31	401.04
	(358.72)	(678.15)	(691.23)
Draft animals	6.40	6.87	4.67
	(4.62)	(6.36)	(6.25)
Farm implements	8.72	8.37	6.81
	(3.79)	(5.80)	(6.90)
Dependents	6.93	7.16	5.50
	(3.77)	(6.91)	(6.50)
Indebtedness at beginning of year	−436.61	170.55	176.75
	(1,073.76)	(656.76)	(931.16)

NOTE.—Standard deviations are in parentheses.

III. A Hedonic Framework

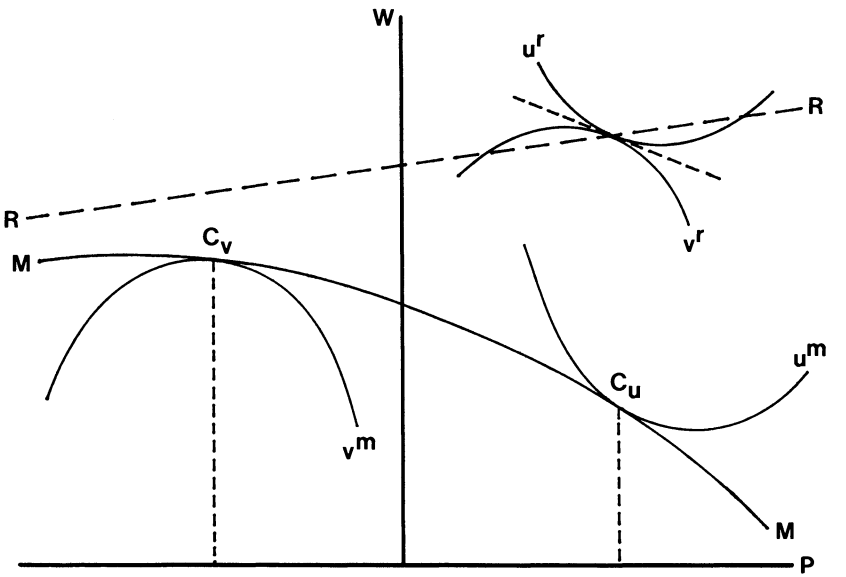
The information presented in tables 1–5 is suggestive though inconclusive. To undertake a systematic exploration of the data, a theoretical framework is required that admits credit and incentive problems for one or both contracting parties. The framework we employ is an adaptation of the standard hedonic pricing model (Rosen 1986), which, in the present context, describes the joint determination of contractual wage levels and wage profiles in competitive markets. At this point we take as given agents' preferences concerning wage levels and profiles and do not specify how these variables are measured. Later sections develop the actual measures that we implement empirically and describe workers' and employers' indirect utility functions over these measures.

Labor market transactions are taken to be tied sales in which workers and employers exchange labor services and contractual payment patterns. When labor quality and contract length are held fixed, freely mobile workers and employers from heterogeneous households choose to participate on opposite sides of a continuum of competitive markets for different wage profile shapes. Wage levels in each market then adjust so that, in equilibrium, no agent has an incentive to change his or her market decision. The resulting locus of equilibrium wage level–wage profile pairs is the market wage equation; its slope is the marginal price of moving between adjacent markets, which is the price of changing a contract's payment profile.

The corresponding diagram is familiar: Consider the market for employment contracts that begin at time T_b and end at T_e, and specify wage functions $w(t)$ on $[T_b, T_e]$. Let $W = W(w(\cdot))$ and $P = P(w(\cdot))$ represent, respectively, scalar measures of the overall wage level and profile. Curve MM in figure 2*a* is the market wage equation describing the equilibrium $\{W, P\}$ pairs available to workers and employers. Curve u^m is an indifference curve of a worker who participates anonymously in a competitive market, and v^m represents the corresponding indifference curve of an employer. Curve C_u (C_v) is the worker's (employer's) optimal contract choice given MM.[12]

[12] This hedonic model nests the standard principal-agent model as a special case. In the principal-agent model, the employer designs contracts to maximize her payoff subject to an explicit worker participation constraint (and, possibly, an implicit incentive constraint). In the hedonic model, when all relevant worker attributes are public information, the wage equation for each such combination of attributes represents the common binding participation constraint of all workers with those attributes. That is, when workers are homogeneous, the wage equation will coincide with a worker indifference curve. However, when some attributes are privately known and the workers and employers in the market are both heterogeneous, the wage equation fails to coincide with any indifference curve or participation constraint.

a



b

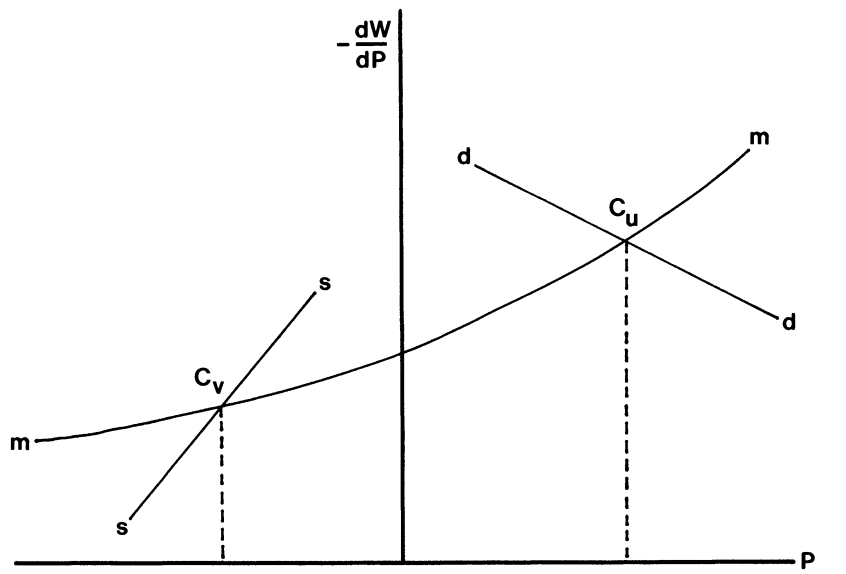


FIG. 2

A. Estimation

The hedonic model of wage profiles is summarized by the following system of three equations:

$$\text{wage equation:} \quad W = f(\mathbf{X}, P),$$

$$\text{demand:} \quad P^d = g\left(\mathbf{Y}^d, -\frac{dW}{dP}\right),$$

$$\text{supply:} \quad P^s = h\left(\mathbf{Y}^s, -\frac{dW}{dP}\right).$$

Multiplying the marginal price of the wage profile by minus one allows us to identify the marginal price as a forgone wage and later to associate demand functions with workers and supply functions with employers.

The wage equation describes a contract's wage level as a function of its wage profile but is otherwise conventional; the vector $\mathbf{X}$ includes measures of the worker's human capital, local market conditions, and seasonal factors. The demand equation represented by *dd* in figure 2*b* describes the "quantity" of wage profile a worker is willing to acquire as a function of a vector of worker attributes, $\mathbf{Y}^d$, and the (marginal) price for wage profiles (which is equated to the worker's marginal rate of substitution [MRS] between W and P, times minus one). The supply equation *ss* has an analogous interpretation.

Joint estimation of a linear version of these equations allows us to identify the determinants of wage levels and profiles in our data. Since the wage equation describes the market-clearing wage levels across a continuum of markets, one for each wage profile shape, it largely reflects the distributions of heterogeneous workers and employers and does not depend directly on any particular motives (credit or incentives) for buying or selling P. Instead, these motives should be revealed by the form of the demand and supply functions. The signs of the estimated coefficients of the price variable, $-dW/dP$, and the shift variables, $\mathbf{Y}^d$ and $\mathbf{Y}^s$, in the demand and supply functions allow us to discriminate among competing hypotheses.

B. Contracting with Relatives

The 427 contracts between nonrelatives in our sample are taken to be the outcomes of anonymous participation in competitive labor markets. It is unclear, however, whether or not the remaining 156 contracts between relatives can also be viewed as market transactions; if not, the hedonic pricing model cannot be used to describe contracting between relatives.

One hypothesis concerning contracts between relatives is that they are the outcomes of bargaining in situations of bilateral monopoly in which the buyer and seller enjoy some match-specific surplus because they are related. The distinction between market transactions and bargaining solutions is depicted in figure 2*a*, where *RR* is the locus of $\{W, P\}$ pairs corresponding to employment contracts between relatives, u^r is an indifference curve of an individual who anticipates working for a relative, and v^r is an indifference curve of an employer who anticipates hiring a relative. Observe that the common MRS of the parties to a contract between relatives generally bears no relation to the slope of the *RR* locus. This means that the slope of *RR* cannot be viewed as the marginal price of a wage profile for relatives and hence cannot be used as the price variable in an analysis of relatives' demand and supply functions.

The alternative hypothesis is that there are no special gains from trading with relatives and that contracts between relatives are also market determined. In terms of figure 2*a*, this implies that *RR* and *MM* coincide and that both u^r and v^r are tangent to *RR*; in terms of our sample, it implies that contracts between relatives are simply the coincidental result of random matching.[13]

Tests for whether or not the market wage equation and the relatives' contract locus coincide are reported in Brandt and Hosios (1994).[14] Our results confirm that these lines differ mainly because relatives price some worker attributes (e.g., the worker's age and skill) differently than the market. Because the contracts between relatives in our sample do not appear to be anonymous market transactions, we opted to restrict attention to the smaller sample of 427 contracts between nonrelatives.

IV. Measuring Wage Levels and Wage Profiles

Summarizing an entire sequence of wages by two scalar measures necessarily entails a compromise. Since alternative measures can have different empirical implications, it is important that our theoretical framework and hypotheses be expressed in terms of the same mea-

[13] In a large economy, it is very unlikely that a random sample of market-determined employment contracts would contain many between relatives. In the small village setting under study here, however, many households in the same village are related to each other. If all contracts in this situation are in fact market determined, we would still expect that a nontrivial portion of the employment contracts in any given village would involve relatives. It follows that the relatively large fraction of contracts between relatives in our sample is a priori not inconsistent with the view that these contracts are market transactions.

[14] Evidence showing that these two wage equations coincide is necessary but not sufficient to establish that contracts between relatives are market transactions.

sures we later take to the data. This means that specific measures must be chosen prior to developing the theory.

To start, each labor contract in our sample is mapped into a discrete-time framework in which each period represents a week. A contract begins at time T_b and ends at time T_e, where $\{T_b, T_e\}$ are nonnegative integers satisfying $48 \geq T_b \geq 0$ and $T_e \geq T_b + 4$.[15] The wage measure we employ is the *real permanent wage,* denoted by y and defined to be the constant weekly real wage that generates the same present discounted value as the actual real wage stream:[16]

$$\text{PDV} = \sum_{t=T_b}^{T_e} \frac{w_t}{(1 + r)^{t-T_b}} = y \sum_{t=T_b+1}^{T_e} \frac{1}{(1 + r)^{t-T_b}},$$

where PDV is the present discounted value of the wage payments associated with a given contract, w_t is the real wage paid at time t of that contract, and r is a village-specific average weekly rate of interest.[17]

Many different wage profile measures can be constructed. Because we are interested in the shape rather than the level of a wage sequence, we restrict attention to measures that are homogeneous of degree zero in wage payments. Perhaps the simplest description of a payment profile is the one introduced earlier that employs two dummy variables: $B = 1$ ($E = 1$) if a single payment is made at the very beginning (end) of the contract, and $B = 0$ ($E = 0$) otherwise. The next obvious candidate is the overall slope of the profile. Letting Σ_1 (Σ_2) denote the sum of all wages paid in the first (second) half of the contract, we define the slope of the wage profile as $S = (\Sigma_2 - \Sigma_1)/(\Sigma_2 + \Sigma_1)$.[18] If we recognize that short and long contracts that prescribe a single payment at the same end have the same slope, a length-adjusted slope measure, $S^* = (T_e - T_b)S$, is also of interest.

We construct an alternative description of a wage profile that is based on the credit implicitly extended during the contract, rather than on the profile's shape per se. Define z_t as the outstanding loan

[15] Note that the first wage payment can coincide with the start of work at $t = T_b$.

[16] A contract's wage stream is based on the pattern of cash payments and in-kind payments (valued at local market prices), but excludes meals and accommodations.

[17] There was substantial cross-village variation in price levels and market rates of interest. Nominal wages are converted to real terms by dividing by the price of the major grain (defined by acreage) in each village in which one or both of the contracting parties reside. On the other hand, the rate of interest, r, is the average weekly market rate of interest among all informal credit contracts undertaken in 1935 in each village. Because we cannot identify an expected rate of inflation for different contract intervals or villages, we take the real and market rates to be the same.

[18] If all payments are made during the first (second) half of a contract, $S = -1$ ($+1$); otherwise, $-1 < S < 1$.

from the employer to the worker at time t:

$$z_{T_b} = w_{T_b},$$
$$z_{t+1} = (1 + r)z_t + w_{t+1} - y, \quad t = T_b, \ldots, T_e - 2.$$

According to this definition, any lending or borrowing between a worker and employer is amortized over the course of their contract so that the outstanding loan at the very end of the contract, at $t = T_e$, is zero. Now consider the following *standardized debt measure:*

$$D = \sum_{T_b}^{T_e - 1} \frac{z_t}{\text{PDV}}.$$

In effect, D is a normalized measure of the average outstanding amount of borrowing by the worker over the course of the contract.[19] Positive (negative) D values result when payments are shifted toward the beginning (end) of a contract. Negative D measures the average outstanding amount of borrowing by the employer.

These wage profile measures are not exhaustive. Furthermore, the slope measures and the standardized debt measure are highly correlated ($\rho_{SD} = -.83$, $\rho_{S*D} = -.95$). After all, when contract length and the permanent wage are taken as given, shifting payments toward the beginning of the contract both decreases the wage profile slope and increases the amount implicitly borrowed by the worker.

Brandt and Hosios (1994) describe single-equation estimates of a series of market wage equations using these alternative wage profile measures. The dependent variable is the log of the real permanent wage; the explanatory variables include one, or some combination, of $\{B, E\}$, $\{S, S^2\}$, $\{S^*, (S^*)^2\}$, and $\{D, D^2\}$ plus a common set detailed later in Section VII. The estimated coefficients of these wage profile measures were found to exhibit a common pattern that depends neither on the particular measure selected nor on the use of ordinary least squares or instrumental variables estimation.[20] As a consequence of this common pattern and because D is highly correlated with S

[19] An alternative standardized debt measure is

$$D^* = (T_e - T_b)^{-1} \sum_{T_b}^{T_e - 1} \frac{z_t}{y}.$$

However, since the correlation between D and D^* is .99, attention is restricted to D.

[20] The estimated coefficients show that the permanent wage (i) is reduced when a single payment is made *either* at the beginning or at the end of the contract (i.e., contracts with two or more payments have higher permanent wages), (ii) is a decreasing function of the *absolute* value of the slope of the wage profile, and (iii) is a decreasing function of the amount implicitly borrowed by *either* the worker ($D > 0$) or the employer ($D < 0$).

and S^* and is the only measure that responds to arbitrary changes in the payment profile, we have chosen to restrict attention to standardized debt in this paper.

Figure 3 depicts the distribution of D for our sample of 427 contracts between nonrelatives. To get a sense of the magnitudes involved here, suppose that $r = 0$ and that the contract length is Δ. In this case D satisfies $.5\Delta + .5 \geq D \geq -.5\Delta + .5$.[21] For example, for a 26-week contract, $\Delta = 26$ and D varies from 13.5 when a single payment is made at the very beginning to -12.5 when a single payment is made at the very end.

V. Wages and Wage Profiles: Theory

This section describes workers' and employers' preferences concerning wages and wage profiles in different economic environments. Our goal is to identify the distinct implications of credit and job-related incentive problems for the underlying demand and supply functions for standardized debt. We are especially interested in the effects of changes in agents' endowments and in the costs borne by perpetrators of malfeasance. The results are recorded in table 6.

Attention is restricted to the simplest nontrivial example. There are three points in time, $t = 0, 1, 2$. Consumption, labor supply, and wage payments take place only at times $t = 0$ and $t = 2$. Each contract specifies a sequence of wages, $\{w_0, w_2\}$, where w_i denotes the wage paid at $t = i$. When we use our earlier definitions and recall that the equivalent permanent wage is paid at $t = 1, 2$, the permanent wage and standardized debt corresponding to $\{w_0, w_2\}$ are[22]

$$y = \frac{w_0(1 + r)^2 + w_2}{2 + r},$$

$$D = \frac{w_0(2 + r)}{w_0 + w_2(1 + r)^{-2}} - \frac{(1 + r)^2}{2 + r}.$$

In this simple example, a contract's standardized debt, D, is a strictly increasing function of the ratio of the initial to final wage payment, w_0/w_2.[23]

[21] Consider a Δ-period contract running from time 0 to time Δ that has only two payments, w_0 and w_Δ. Using the expressions for y and D, we have PDV $= w_0 + w_\Delta = y\Delta$ and $D = (w_0/y) - [(\Delta - 1)/2]$. When $w_\Delta = 0$, $D = (\Delta/2) + .5$; when $w_0 = 0$, $D = -(\Delta/2) + .5$.

[22] In the special case of a contract with at most two payments, either $\{w_0, w_2\}$ or $\{y, D\}$ provides a complete description of the contractual wage pattern. When there are three or more payments, however, some information is lost when $\{y, D\}$ is used.

[23] The wage profile slope, $S = (w_2 - w_0)/(w_2 + w_0)$, is a strictly decreasing function of the same wage ratio.

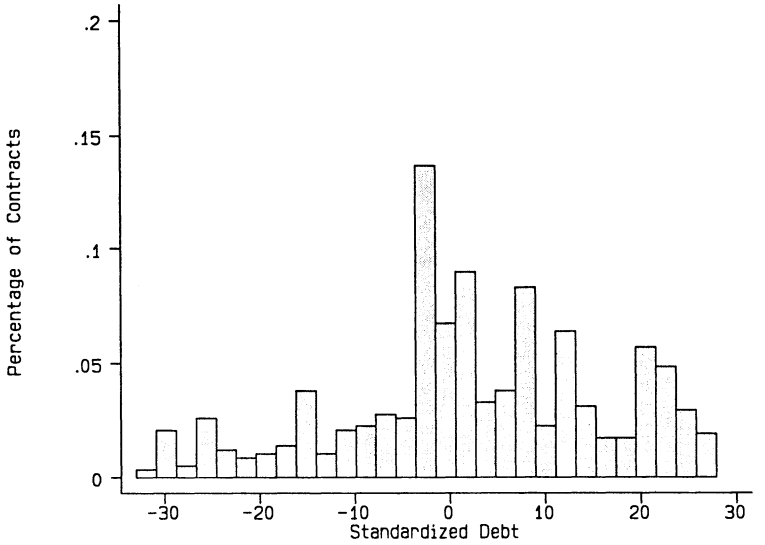


FIG. 3.—Distribution of standardized debt

For any given credit or incentive problem, we first specify a worker's indirect utility function, $u(w_0, w_2)$, and then describe the corresponding preferences for the permanent wage and standardized debt, $U(y, D)$.[24] The analogous payoff functions for employers are represented by $v(w_0, w_2)$ and $V(y, D)$. Recall that agents' MRSs, $-U_D/U_y$ and $-V_D/V_y$, are multiplied by minus one so that the price of marginally shifting payments toward the beginning of the contract becomes the corresponding permanent wage reduction. In effect, U_D/U_y is a worker's marginal bid price for D:

$$-\left.\frac{dy}{dD}\right|_U = \frac{\dfrac{dw_0}{dD} + \dfrac{u_2}{u_0}\dfrac{dw_2}{dD}}{\dfrac{dw_0}{dy} + \dfrac{u_2}{u_0}\dfrac{dw_2}{dy}}, \tag{1}$$

where $dw_i/dy > 0$, $dw_0/dD > 0$, and $dw_2/dD < 0$; given $\{y, D\}$, U_D/U_y varies directly with u_0/u_2. Substituting v_2/v_0 for u_2/u_0 above yields the

[24] Even in a simple two-period problem, the indirect utility function should be written as $\phi(w_0, \mathbf{p}_0, w_2, \mathbf{p}_2)$, a function of the agent's income stream and a sequence of price vectors. In this paper, we assume that ϕ can be written as $\phi(u(w_0, w_2), \mathbf{p}_0, \mathbf{p}_2)$, so that the marginal rate of substitution between w_0 and w_2, and hence between y and D, does not depend on $\{p_t\}$.

TABLE 6

PREDICTIONS OF THE MODEL

	DEMAND				SUPPLY			
	$\frac{\partial \rho^d}{\partial D}$	$\frac{\partial \rho^d}{\partial e_w}$	$\frac{\partial \rho^d}{\partial w_a}$	$\frac{\partial \rho^d}{\partial R}$	$\frac{\partial \rho^s}{\partial D}$	$\frac{\partial \rho^s}{\partial e_e}$	$\frac{\partial \rho^s}{\partial w_a}$	$\frac{\partial \rho^s}{\partial R}$
Credit problems	−	−	0	0	+	−	0	0
Worker incentive problems:								
Pure; no termination	0	0	0	0	0	0	0	0
Mixed; no termination	−	−	0	$\gtrless 0$ as $D \lesseqgtr \hat{D}$	+	−	0	$\gtrless 0$ as $D \gtreqless \hat{D}$
Pure; full termination	+	≥ 0	+	$-$ and $\frac{\partial}{\partial D}\left(\frac{\partial \rho^d}{\partial R}\right) < 0$	+	≥ 0	+	$-$ and $\frac{\partial}{\partial D}\left(\frac{\partial \rho^s}{\partial R}\right) < 0$
Employer incentive problems:								
Pure; no termination	0	0	0	0	0	0	0	0
Mixed; no termination	−	−	0	$\gtrless 0$ as $D \gtreqless \hat{D}$	+	−	0	$\gtrless 0$ as $D \gtreqless \hat{D}$
Pure; full termination	−	≥ 0	0	$-$ and $\frac{\partial}{\partial D}\left(\frac{\partial \rho^d}{\partial R}\right) > 0$	−	≥ 0	0	$-$ and $\frac{\partial}{\partial D}\left(\frac{\partial \rho^s}{\partial R}\right) > 0$
Matchmaker:								
Worker productivity	−	−	0	0	+	−	0	$\gtrless 0$ as $D \lesseqgtr \hat{D}$
Working conditions	−	−	0	$\gtrless 0$ as $D \lesseqgtr \hat{D}$	+	−	0	0

NOTE.—ρ^d (ρ^s) denotes a worker's (employer's) marginal bid (offer) price for standardized debt, D denotes standardized debt, e_w (e_e) denotes the worker's (employer's) first-period endowment, w_a denotes the worker's second-period alternative wage, R denotes the reputational cost borne by an agent who is caught shirking, and $\hat{D}$ denotes the level of standardized debt corresponding to a flat wage profile.

corresponding expression for an employer's marginal offer price, V_D/V_y.

The model we develop admits implicit lending between contracting parties and job-related incentive problems, allows for one or both of them to engage in malfeasance, and highlights the role of reputation and terminations in mitigating such behavior.[25] Our aim is to describe the effects that agents' attributes and features of the contracting environment have on workers' and employers' marginal bid and offer prices for standardized debt. To simplify, we initially restrict problems of moral hazard to workers; consideration of employer malfeasance is postponed to subsection *E*.

A. *The Model*

Consider an environment in which an individual worker's output and effort cannot be verified directly. Employment takes place at times $t = 0$ and $t = 2$, which are labeled the first and second periods, respectively. In each period, a worker chooses an effort level, h_t, and is paid w_t. The pair $\{w_t, h_t\}$ provides workers and employers with payoff $\mu(w_t - h_t)$ and $\nu(\alpha h_t - w_t)$, respectively, where α denotes the worker's marginal product. Unless specified otherwise, μ *and* ν *are strictly* increasing, concave functions. The common discount factor is δ.

Let $p(h_t)$ denote the probability that a worker who expends h_t is perceived to supply effort above some standard. That is, with probability $1 - p(h_t)$, a worker is perceived to shirk in period t. We suppose that this signal is publicly observed and induces a community response that adversely affects the worker's exchanges in other markets (Bendor and Mookherjee 1990; Kandori 1992). The additively separable utility loss resulting from these trade restrictions, R, is a reputational cost and may be history-dependent.

We begin by solving the worker's second-period effort choice problem. This problem is contingent on publicly observable first-period events. Define $X(w, R) = \max_h\{\mu(w - h) - [1 - p(h)]R\}$. A worker who is retained (i.e., not fired) at the end of the first period enjoys expected second-period utility $X(w_2, R_{s2})$ if he shirked during the first period and $X(w_2, R_{n2})$ otherwise; that is, R_{s2} denotes the marginal reputational cost imposed on a worker who shirked during the first period and is caught again in the second period, and R_{n2} is the cost when the worker is caught for the first time. Presumably, $R_{s2} \leq R_{n2}$. Fired workers secure one-period employment contracts elsewhere paying wage w_a and so enjoy $X(w_a, R_a)$. We assume that the reputa-

[25] The version of this model that ignores reputation issues and assumes that shirking causes an immediate separation is similar to the two-period model in Lazear and Moore (1984), which draws on Lazear (1981).

tional loss associated with quitting at the end of the first period is sufficient to discourage this behavior.

Suppose that employers can commit with probability λ to terminating shirking workers at the end of the first period of employment. For any given wage contract $\{w_0, w_2\}$, the value of λ that a worker expects an employer to adopt, denoted λ^e, is a function of $\{w_0, w_2\}$; in equilibrium, λ^e equals the employer's optimal termination probability given $\{w_0, w_2\}$. Thus, when $\{w_0, w_2\}$ and hence λ^e are taken as given, a worker's payoff from contract $\{w_0, w_2\}$ equals

$$u(w_0, w_2) = \max_{h_0} \{\mu(e_w + w_0 - h_0) + p(h_0)\delta X(w_2, R_{n2}) + [1 - p(h_0)] \times \{-R_0 + (1 - \lambda^e)\delta X(w_2, R_{s2}) + \lambda^e \delta[X(w_a, R_a) - R_f]\}\},$$

where e_w is the worker's initial endowment. Here, R_0 denotes the reputational cost borne by a worker who is caught shirking during the first period, and $R_0 + \delta R_f$ represents the total reputational cost when the worker is caught and fired.[26]

Since a worker's optimal effort levels, h_0^*, h_{n2}^*, and h_{s2}^*, depend on both the pattern of wages and the termination probability, an employer's payoff from contract $\{w_0, w_2\}$ is

$$v(w_0, w_2) = \max_{\lambda} \{\nu(e_e + \alpha h_0^* - w_0) + p(h_0^*)\delta\nu(\alpha h_{n2}^* - w_2) + [1 - p(h_0^*)](1 - \lambda)\delta\nu(\alpha h_{s2}^* - w_2)\},$$

where e_e is the employer's initial endowment.

We develop the comparative static properties of this model below and summarize the results in table 6. These results describe the responses of a worker's marginal bid price, $\rho^d = U_D/U_y$, and an employer's marginal offer price, $\rho^s = V_D/V_y$, to changes in standardized debt, in a household's assets, in a worker's alternative wage, and in a reputation cost variable.

[26] A possible explanation for a firing-contingent reputational cost, R_f, that is distinct and separate from the effects of sanctions (punishments) on first-period shirkers, R_0, runs as follows: The optimal termination probability depends on a worker's marginal product (see eq. [2] below). Suppose that this termination probability is a monotonic function of the worker's productivity. If aspects of a worker's productivity are known only by his current employer, the market will make inferences concerning a worker's productivity from the fact that he has been fired (Gibbons and Katz 1991). Then R_f is meant to capture the differential return to a worker with an employment history that includes a termination. The role played here by the reputational costs, $\{R_0, R_{n2}, R_{s2}\}$, is analogous to that of the career concerns considered in Gibbons and Murphy (1992). While we associate these costs with sanctions or punishments that are contingent on signals of effort, Gibbons and Murphy identify career concerns with the market's revision of a worker's ability contingent on signals of output.

B. Credit[27]

In this subsection we abstract from moral hazard problems by supposing that the probability that a worker is perceived to have supplied a satisfactory level of effort is a step function; specifically, $p(h) = 0$ for $h < \underline{h}$ and $p(h) = 1$ otherwise. Further, we suppose that reputational costs $\{R_0, R_{n2}\}$ exceed $\mu(0) - \mu(-\underline{h})$. In these circumstances, a worker's optimal effort level is constant and an employer's optimal termination probability is zero, that is, $\{h_0^*, h_{n2}^*\} = \{\underline{h}, \underline{h}\}$ and $\lambda = 0$. Hence $u(w_0, w_2) = \mu(e_w + w_0 - \underline{h}) + \delta\mu(w_2 - \underline{h})$ and $v(w_0, w_2) = \nu(e_e + \alpha\underline{h} - w_0) + \delta\nu(\alpha\underline{h} - w_2)$.

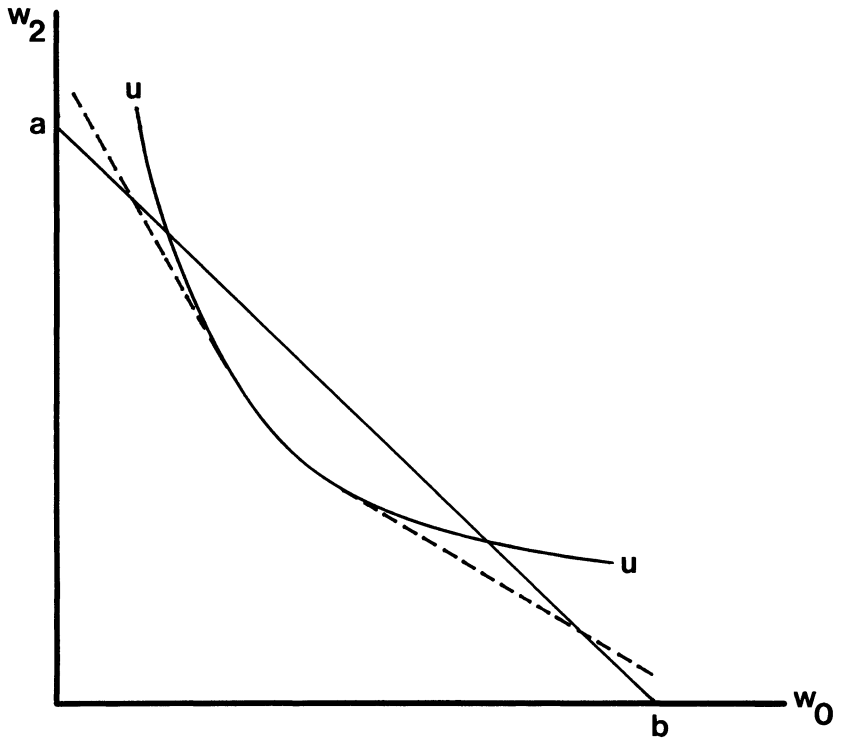
The permanent wage and standardized debt associated with each labor contract in a village are constructed using the average rate of interest on explicit credit contracts in that village. Denote this average interest rate by r. Line ab in figure 4*a* has slope $-(1 + r)^2$ and depicts $\{w_0, w_2\}$ pairs having the same permanent wage. Line uu is an indifference curve of $u(w_0, w_2)$ for a worker who can neither lend nor borrow. The dashed line, by contrast, is an indifference curve for a worker whose borrowing rate exceeds his lending rate of interest. Finally, a worker who borrows and lends at the same rate, say k, has straight-line indifference curves with slope $-(1 + k)^2$.

The indifference curve of $U(y, D)$ corresponding to uu is convex shaped, as illustrated by UU in figure 4*b*; along line ab in figure 4*a* and along the corresponding line AB with a zero slope in figure 4*b*, the permanent wage is fixed and standardized debt rises continuously in moving from a to b (A to B). Since UU is convex, the corresponding compensated demand function for standardized debt is downward sloping. Also, since the worker's marginal rate of substitution between the final and initial payments, u_0/u_2, is a decreasing function of his endowment, his marginal bid price, U_D/U_y in (1), is also a decreasing function e_w. That is, increasing the worker's initial assets induces him to opt for contracts with steeper wage profiles that entail smaller implicit loans from the employer to the worker; the demand for standardized debt is a decreasing function of the worker's initial endowment.

Modeling employers is also straightforward. Line VV in figure 4*b* represents an indifference curve of $V(y, D)$ and corresponds to an

[27]This subsection describes a worker's derived demand for standardized debt when that worker is constrained in the credit market. This demand is independent of his employer's access to the credit market. However, a second and related motive underlying a worker's demand for D is the possibility of employer default when the employer is credit constrained. This default issue was described earlier in Sec. IIA and is modeled, tested, and rejected in our working paper (Brandt and Hosios 1994).

a



b

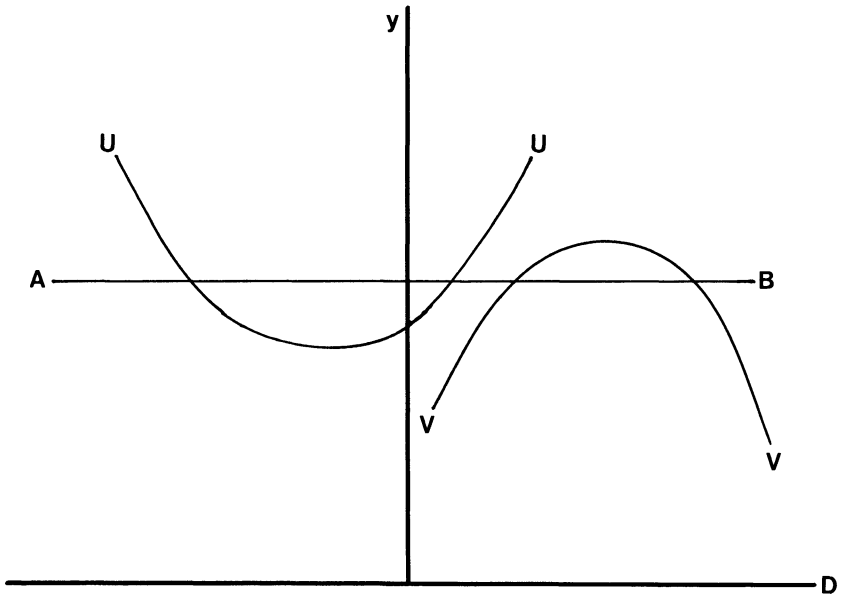


FIG. 4

indifference curve of the indirect utility function $v(w_0, w_2)$. Hence an employer's marginal offer price is an increasing function of D and a decreasing function of his initial endowment. Finally, in the absence of terminations, workers' alternative employment opportunities do not affect the marginal prices for debt.

One benchmark is noteworthy: If $\mu(x) = x$ and $\delta = (1 + r)^{-2}$, each indifference curve of $u(w_0, w_2)$ is a straight line with slope $-(1 + r)^2$, each indifference curve of $U(y, D)$ is a horizontal line, and the demand for debt is perfectly elastic. Correspondingly, if $\nu(x) = x$ and $\delta = (1 + r)^{-2}$, the indifference curves of $V(y, D)$ are horizontal lines, and the supply of debt is perfectly elastic. Thus, for an agent with unrestricted access to the credit market, the standardized debt associated with an employment contract is inconsequential.

C. *Multicontract Households*

The members of a worker's household may participate in multiple labor contracts over the course of the year. These contracts may have different starting dates and lengths, and involve the same or different individuals. In Brandt and Hosios (1994), we propose distinct credit- and incentive-based explanations for why these other household employment contracts can affect a given worker's demand for the standardized debt of his own employment contract. In particular, we show that the effect on demand of the temporal income pattern of these other household contracts will be the same in both situations. Likewise, for an employer with multiple employment contracts over the year, the effect of the temporal pattern of wage payments of all other contracts on his supply of debt to a given contract is the same, independent of whether credit or incentive issues are important. Thus estimating the impact of other household contracts on an individual worker's or employer's contract choices will be uninformative with respect to the underlying motive for contract choice. Since the latter issue remains central and since the remaining coefficients of the model are not significantly affected by the inclusion of summary measures of these other household contracts, we opted to shorten the exposition and ignore them below.

D. *Worker Malfeasance*

To examine incentive issues, we suppose that the probability of nondetection, $p(\cdot)$, is a strictly increasing, concave function of effort. It follows that (i) the worker's optimal second-period effort level, h_{n2}^* (h_{s2}^*), is an increasing function of w_2 and the corresponding reputational loss associated with being labeled as a shirker,

R_{n2} (R_{s2}); (ii) the optimal first-period effort level, h_0^*, is likewise an increasing function of w_0 and R_0; and (iii) h_0^* is an increasing (decreasing) function of the expected termination probability, λ^e, whenever $X(w_2, R_{s2}) > (<) X(w_a, R_a) - R_f$. In other words, increasing the termination probability induces greater effort if and only if, after one accounts for the stigma of being fired, termination makes the worker worse off. To simplify, we now set endowments to zero and $\delta = 1$.

Determining the optimal termination probability involves a straightforward benefit-cost comparison. Evaluated at $\lambda = 0$, the employer's net marginal benefit from increasing λ equals

$$\alpha \frac{dh_0^*}{d\lambda} v'(\alpha h_0^* - w_0) - [1 - p(h_0^*)]v(\alpha h_{s2}^* - w_2), \tag{2}$$

where, from the worker's problem,

$$\text{sign}\left(\frac{dh_0^*}{d\lambda}\right) = \text{sign}[X(w_2, R_{s2}) - X(w_a, R_a) + R_f].$$

The first term in (2) is the utility gain from the induced change in the worker's first-period effort level; the second term is the corresponding utility loss from firing the worker and forgoing $\alpha h_{s2}^* - w_2$. The termination probability thus depends on the pattern of wages and the reputational costs.[28] While termination probabilities are unobservable, we can still test for whether or not they are important by identifying the different effects of reputational losses on the demand for and supply of standardized debt in regimes with and without terminations.

[28] Observe first that if wage payments are shifted sufficiently toward the beginning of the contract, so that $dh_0^*/d\lambda < 0$, (2) becomes negative and the optimal termination probability is zero. Indeed, with a single up-front payment and no firing-contingent costs ($R_f = 0$), it cannot possibly pay to threaten to fire workers who shirk. When payments are skewed toward the end of the contract, however, the benefit of terminating shirkers increases and the cost decreases. If $v(0) = 0$, values of w_2 can be found such that (2) is positive for all λ, whence $\lambda^* = 1$. Reputational effects are also straightforward: On one hand, evaluated at $\lambda = 0$, $dh_0^*/d\lambda$ is an increasing function of the firing-contingent reputational cost and h_0^* is independent of R_f; hence, a sufficiently large firing-contingent reputational cost will result in terminations. On the other hand, for fixed R_f, increasing the remaining reputational costs of being labeled a shirker increases the worker's effort levels throughout the contract period, which decreases the benefit while increasing the cost of committing to firing shirkers. In other words, if reputational losses are already substantial, using an additional "stick" to extract even more from the worker becomes self-defeating; for large enough $\{R_0, R_{s2}\}$, (2) is negative and $\lambda^* = 0$.

No-Termination Contracts ($\lambda = 0$)

In this case,

$$\frac{u_0}{u_2} = \frac{\mu'(w_0 - h_0^*)}{p(h_0^*)\mu'(w_2 - h_{n2}^*) + [1 - p(h_0^*)]\mu'(w_2 - h_{s2}^*)},$$

$$\frac{v_0}{v_2} = \frac{\nu'(\alpha h_0^* - w_0)}{p(h_0^*)\nu'(\alpha h_{n2}^* - w_2) + [1 - p(h_0^*)]\nu'(\alpha h_{s2}^* - w_2) - A(dh_0^*/dw_2)}, \quad (3)$$

$$A = \alpha\nu'(\alpha h_0^* - w_0) + p'(h_0^*)[\nu(\alpha h_{n2}^* - w_2) - \nu(\alpha h_{s2}^* - w_2)],$$

where

$$\operatorname{sign}\left(\frac{dh_0^*}{dw_2}\right) = \operatorname{sign}[\mu'(w_2 - h_{s2}^*) - \mu'(w_2 - h_{n2}^*)].$$

To begin, consider a *pure* incentive problem in which credit considerations are entirely absent, that is, $\mu' = \nu' = 1$. In this case, the no-termination feature implies that the wage profile shape must be inconsequential; from (3), the demand for and supply of standardized debt are perfectly elastic and unaffected by the parties' asset positions or the worker's reputational costs. Indeed, given $X(w, R) = \max_h\{w - h - R[1 - p(h)]\}$, reputational cost is the only positive influence on effort.

In the *mixed* case, where credit and incentive problems are both present, it is helpful to draw a distinction between history-dependent and history-independent reputational costs. When reputational costs are history *in*dependent, so that $R_0 = R_{n2} = R_{s2}$, the worker's optimal second-period effort level is independent of whether or not he was caught shirking during the initial period of employment. Substituting $h_{s2}^* = h_{n2}^* = h_2^*$ into (3) yields

$$\frac{u_0}{u_2} = \frac{\mu'(w_0 - h_0^*)}{\mu'(w_2 - h_2^*)},$$

$$\frac{v_0}{v_2} = \frac{\nu'(\alpha h_0^* - w_0)}{\nu'(\alpha h_2^* - w_2)}. \quad (3')$$

Thus, with history-independent reputational costs, our earlier analysis of pure credit problems implies that, in the mixed case, demand (supply) is a decreasing (increasing) function of both the marginal price of standardized debt and the worker's (employer's) household assets.

From (3′), the impact on a worker of an increase in the common

reputational cost, R, is described by

$$\frac{d(u_0/u_2)}{dR} \propto \frac{\mu''(w_2 - h_2^*)}{\mu'(w_2 - h_2^*)} \frac{dh_2^*}{dR} - \frac{\mu''(w_0 - h_0^*)}{\mu'(w_0 - h_0^*)} \frac{dh_0^*}{dR}.$$

If we let $p(h) = 1 - e^{-ah}$ (and use the first-order condition $p'R = \mu'$), this simplifies to

$$\frac{d(u_0/u_2)}{dR} \propto \frac{\mu''(w_2 - h_2^*)}{\mu'(w_2 - h_2^*)} - \frac{\mu''(w_0 - h_0^*)}{\mu'(w_0 - h_0^*)}.$$

Suppose that workers' coefficient of absolute risk aversion, $-\mu''/\mu'$, decreases with income. In this case, an increase in R decreases (increases) u_0/u_2 and hence decreases (increases) the marginal bid price, U_D/U_y, as long as w_0 is greater (less) than w_2.[29] If $-\nu''/\nu'$ is a decreasing function of income, it likewise follows that when w_0 is greater (less) than w_2, increasing R decreases (increases) v_0/v_2 and hence decreases (increases) the marginal offer price, V_D/V_y. Greater reputational costs effectively cause the demand and supply curves to pivot at a small positive value of D, denoted by $\hat{D}$ in table 6, corresponding to a flat wage profile ($w_0 = w_2$).

Without terminations, the second-period wage can still influence the first-period effort decision, but only when first-period effort and the likelihood of being labeled a shirker affect the worker's expected second-period payoff. In particular, w_2 has a positive impact on h_0 only if reputational costs are history-dependent, that is, $R_{s2} < R_{n2}$. Since agents' MRSs with no-termination contracts and history-dependent reputational costs are similar to those with full-termination contracts, we proceed directly to the latter case.

Full-Termination Contracts ($\lambda = 1$)

Observe that when shirking workers are always fired, history-dependent reputational costs are irrelevant because all retained workers have the same employment history. Now, with $\lambda = 1$,

$$\frac{u_0}{u_2} = \frac{\mu'(w_0 - h_0^*)}{p(h_0^*)\mu'(w_2 - h_{n2}^*)},$$

$$\frac{v_0}{v_2} = \frac{\nu'(\alpha h_0^* - w_0)}{p(h_0^*)\nu'(\alpha h_{n2}^* - w_2) - [\alpha\nu'(\alpha h_0^* - w_0) + \nu(\alpha h_{n2}^* - w_2)p'(h_0^*)](dh_0^*/dw_2)}, \quad (4)$$

[29] This result follows from the fact that, given preferences $\mu(w - h)$, the solution to the worker's effort choice problem implies that the worker's optimal effort level and net income, h^* and $w - h^*$, are both increasing functions of w.

where $dh_0^*/dw_2 > 0$. Comparing (3) and (4), we see that when $R_{s2} < R_{n2}$, the main properties of no-termination contracts are generally exhibited here as well.[30] The distinguishing properties of full-termination contracts are also present with *pure* incentive problems. When $\mu(x) = \nu(x) = x$, (4) yields

$$\frac{u_2}{u_0} = p(h_0^*)$$

and

$$\frac{v_2}{v_0} = p(h_0^*) - [\alpha + (\alpha h_2^* - w_2)p'(h_0^*)]\frac{dh_0^*}{dw_2}.$$

These expressions imply the following statements (see table 6): (i) The demand and supply curves for standardized debt are *both* positively sloped. (ii) As the reputational costs of shirking during the first period, $\{R_0, R_f\}$, increase, the worker's initial effort increases, so that u_0/u_2 and the marginal bid price decrease; because reputational costs are substitutes for contractual incentives, "more trustworthy" workers who face larger reputational costs will pay less for any given "amount" of contractual incentives. (iii) As a worker's alternative wage, w_a, increases, terminations become less threatening, his initial effort decreases, and his marginal bid price increases. To the extent that increasing a worker's household assets increases his home productivity and thereby increases his alternatives to market employment, increasing these assets should likewise increase the worker's marginal bid price. (iv) As w_2 increases, the impact of $\{R_0, R_f\}$ on h_0^* decreases; that is, when D is a large negative number and the payment schedule is already providing strong incentives, enhancing reputational costs will not significantly alter behavior. (v) On the supply side, since greater reputational costs decrease dh_0^*/dw_2, increase $\{h_0^*, h_{n2}^*\}$, and hence decrease $p'(h_0^*)$, employers will tend to offer standardized debt at lower prices to more trustworthy workers and use a price discount that increases with D. (vi) Increased employer assets that increase worker productivity (α) will generally raise v_0/v_2 and hence raise V_D/V_y; employers with more productive technologies offer contracts with steeper wage profiles (smaller D's) to induce workers to expend greater effort.

E. Employer Malfeasance

Working conditions or nonpecuniary remuneration supplied by the employer that cannot be contractually prescribed can give rise to a

[30] One key difference is that the worker's alternative wage, w_a, has a direct effect on the demand for and supply of standardized debt only when $\lambda > 0$.

moral hazard problem that is analogous to the employee shirking problem. Modeling this situation is straightforward: Let c_t denote the conditions the employer chooses to provide in period t. Suppose that a worker's and employer's payoffs from $\{w_t, c_t\}$ are $\mu(w_t + \beta c_t)$ and $\nu(\alpha \underline{h} - w_t - c_t)$, respectively, with $\beta > 0$. Define $p(c_t)$ to be the probability that an employer who provides c_t is perceived by the market to have supplied satisfactory working conditions. And finally, suppose that workers can credibly commit to quitting at the end of the first period of employment if their employers are perceived to have provided substandard working conditions.

This formulation of the employer malfeasance problem effectively reverses the roles of workers and employers in the agency component of the employment relationship. As a result, contractual incentives are enhanced by increasing rather than decreasing D. A formal analysis of the employer malfeasance problem can thus be omitted. The main results are recorded in table 6.

F. *Matchmakers*

When there is an incentive problem, reputational costs are likely to be enhanced when the parties to a contract either are members of the same community or are brought together by a matchmaker. In the absence of any incentive problem, the same arrangements may signal greater knowledge of trading partners and, hence, the selection of more desirable partners, that is, more productive workers or employers with better working conditions. By testing for consistent shifts in both demand and supply, we can distinguish enhanced reputational costs from selection effects.

Suppose that there is no incentive problem, so that (3′) holds with $h_i^* = h^*$, but firms are potentially able to identify and hire more productive (higher-α) workers. In terms of the supply curve for standardized debt, it does not matter whether αh is large because α or h is large, and so the effect of superior knowledge is indistinguishable from the impact of enhanced reputational costs in the presence of a shirking problem with no-termination contracts. In terms of the demand curve, however, greater knowledge of this kind will not have any effect. Analogously, if workers are able to identify employers who supply better working conditions, the demand-side impact of this superior information is the same as the demand-side impact of enhanced reputational costs in the case of employer malfeasance. Correspondingly, an informational advantage should not affect supply. These results are also recorded in table 6.

VI. The Econometric Model

The econometric model consists of three equations: a wage equation, a demand equation for standardized debt, and a supply equation.

Each observation is a contract. Observations are available from V geographically distinct villages. With the subscript denoting individual observations dropped, the observation from village v is

$$w_v = \beta_0 + \boldsymbol{\beta}_1' \mathbf{X}_v + \beta_{2v} D_v + \tfrac{1}{2}\beta_{3v} D_v^2 + \beta_{4v} D_v S_v + \beta_{5v} D_v T_v + \epsilon_v, \quad (5)$$

where $w_v = \log y_v$; y_v is the contract's permanent wage; $\mathbf{X}_v$ is a vector describing attributes of the village, the worker, and the contract's temporal structure; D_v is the contract's standardized debt measure; S_v is a dummy variable that equals one only if the employer and employee are from the same village; and T_v is a dummy variable that equals one only if there is a third party to the contract. The stochastic error term, ϵ_v, is attributed to possible measurement problems and to unobserved worker attributes. Some of the endogenous right-hand-side contract variables (D_v, S_v, T_v, and duration, denoted by $T_e - T_b$) may be correlated with ϵ_v.

If marginal price is defined as $p_v = -dw_v/dD_v$, the corresponding demand and supply equations are described, respectively, by

$$D_v^d = a_0 - a_1 p_v + \mathbf{a}_2' \mathbf{Y}_v^d + \epsilon_v^d,$$
$$D_v^s = b_0 + b_1 p_v + \mathbf{b}_2' \mathbf{Y}_v^s + \epsilon_v^s,$$

where $\mathbf{Y}_v^d$ ($\mathbf{Y}_v^s$) is a vector that includes worker (employer) attributes, temporal features of the contract, and the relationship between the contracting parties; and ϵ_v^d (ϵ_v^s) is a disturbance term that can be decomposed into an unobserved "taste" or attribute component, which may be correlated with elements of $\{S_v, T_v, T_e - T_b\}$, plus a purely random component that may reflect measurement error.

This hedonic system is not a typical simultaneous equation system. Two issues are important: first, the need for marginal prices that are orthogonal to the structural regressors and, second, the choice of identifying instruments. Each of these issues is examined in turn below. We also present reduced-form estimates and discuss the validity of certain exclusionary restrictions.

A. *Prices and Regressors*

The wage equation for any one market is the equilibrium outcome of a matching process that brings together workers and employers with different preferences concerning $\{y, D\}$. Thus different distributions of agents across markets should affect the matching process and

should thereby yield a different marginal price function for each market. If we model the $\{\beta_{iv}\}_{i=2}^{5}$ by $\beta_{iv} = \boldsymbol{\gamma}_i' \mathbf{Z}_v$, where $\mathbf{Z}_v$ is a vector of village-level variables, the wage equation in (5) allows the marginal price of standardized debt to vary across markets. The parameters of the market wage equation to be estimated are the scalar β_0 and the vectors $\boldsymbol{\beta}_1$ and $\{\boldsymbol{\gamma}_i\}$.

If agents' preferences are independent of where they reside, the constructed marginal prices will embody variation (through the village-level variables in $\mathbf{Z}_v$) that is orthogonal to the structural regressors in the estimated demand and supply functions for standardized debt. This property of marginal prices is needed to identify the latter functions.[31] That is, identification is problematic if the linearly additive determinants of the marginal price of debt ($\mathbf{Z}_v$) also appear as linearly additive determinants of the demand for or supply of debt ($\mathbf{Y}_v^d$, $\mathbf{Y}_v^s$).

Ideally, the aggregate measures in $\mathbf{Z}_v$ reflect the composition of demand and supply in the market and are uncorrelated with individual employee or employer attributes. Villagewide average asset holdings per household influence the local matching process and are obvious candidates for inclusion in $\mathbf{Z}_v$. In our sample of relatively small villages, however, these villagewide average household holdings tend to be correlated with individual households' corresponding asset holdings. Since a household's assets are likely determinants of its members' demands for and supplies of standardized debt in individual contracting situations, villagewide average asset holdings per household cannot be included in $\mathbf{Z}_v$. Instead, we chose to include the coefficients of variation of the various asset endowments among the households in village v as an alternative set of determinants of the matching process in the village. These coefficients of variation are uncorrelated with individual households' corresponding asset holdings.

B. Instruments

The demand and supply equations introduced above do not constitute a conventional demand-supply system. In the conventional case, when the price is a regressor, the price will be correlated with the residuals because of the interaction of demand and supply. Consistent estimation then requires that instruments be found for the price and elements of $\mathbf{Y}_v^i$ that are correlated with $\boldsymbol{\epsilon}_v^i$. In this conventional case,

[31] This identification problem has been described by Brown and Rosen (1982), Brown (1983), Diamond and Smith (1985), and Mendelsohn (1985).

the exogenous variables in $\{\mathbf{Y}_v^d, \mathbf{Y}_v^s\}$ are obvious candidates for instruments; in particular, the exogenous variables in the supply (demand) equation can be used as instruments in the demand (supply) equation.

In a hedonic context, the marginal price is also correlated with the residuals of the structural demand and supply equations, but for a very different reason. Here, each agent is a small player who cannot influence the wage equation and hence cannot influence agents on the other side of the market; there is no demand-supply interaction of the conventional type. Nevertheless, the market wage equation generates a relation between dw_v/dD_v and D_v across wage profile markets, and this implies that market choice by a price-taking agent is effectively a choice of $\{dw_v/dD_v, D_v\}$. Thus dw_v/dD_v will be correlated with the ϵ_v^i, and, as before, instruments must be found for the marginal price and those elements of $\mathbf{Y}_v^i$ that are correlated with ϵ_v^i.

Bartik (1987), Epple (1987), and Kahn and Lang (1988) have shown that, as a consequence of the self-selection by heterogeneous agents across markets in the hedonic model, supply variables *cannot* be used as instruments in the demand equation, and vice versa. The idea is straightforward: Depending on his observed attributes, $\mathbf{Y}_v^s$, an employer will opt to participate in a particular market and so offer a contract with a particular standardized debt value, D. Likewise, depending on her *un*observed tastes and attributes, which are components of ϵ_v^d, a worker will choose to participate in a particular market and accept a contract with a particular D value. Thus, while neither party need be especially concerned with the attributes of his or her trading partner, their independent market choices induce a correlation between the elements of $\mathbf{Y}_v^i$ and ϵ_v^j $(i \neq j)$. Hence $\mathbf{Y}_v^d$ $(\mathbf{Y}_v^s)$ cannot be used as instruments in the supply (demand) equation, and so each of the three equations in the full model requires a different instrument set. The instruments are described below in subsection *C*.

Substitute for $-dw_v/dD_v$ to get the following demand and supply equations:

$$
\begin{aligned}
D_v^d &= \frac{a_0 - \beta_{2v} - \beta_{4v}S_v - \beta_{5v}T_v + \mathbf{a}_2'\mathbf{Y}_{1v} + \epsilon_{1v}}{1 + a_1\beta_{3v}}, \\
D_v^s &= \frac{b_0 - \beta_{2v} - \beta_{4v}S_v - \beta_{5v}T_v + \mathbf{b}_2'\mathbf{Y}_{2v} + \epsilon_{2v}}{1 + b_1\beta_{3v}}.
\end{aligned} \tag{6}
$$

Equations (5) and (6) constitute the system to be estimated. Since $\beta_{iv} = \boldsymbol{\gamma}_i'\mathbf{Z}_v$ $(i = 2, \ldots, 5)$, the cross-equation restrictions in this system are imposed on the elements of the $\boldsymbol{\gamma}_i$ vectors. The complete system is estimated using a generalized method of moments estimator, modified to allow the instrument list to vary by equation.

C. *Reduced-Form Results*

We estimated reduced-form equations for a contract's log permanent wage and standardized debt, w_v and D_v. The explanatory variables and estimated coefficients are reported in table 7. The explanatory variables are all exogenous in the sense that their values were determined prior to the 1935 contracting period. These variables, their squared values, and interactions are the instrumental variables used in estimation of the structural hedonic model.

We have grouped the explanatory variables into four mutually exclusive subsets (more detailed descriptions are provided in Sec. VII). (1) The *employee's human capital* is described by four dummy variables distinguishing skilled, semiskilled, and unskilled agricultural workers and skilled and unskilled nonagricultural workers; age and age squared; two family background dummy variables that identify the family's primary income source (hires out in agriculture, farms own or rented land, or engages in nonagricultural activities); and the number of months the worker worked for the current employer prior to 1935. (2) The *village* is described by the mean per household endowments of land, draft animals, and farm implements; the average land quality in the village; the percentage of households engaged in nonagricultural employment; and the coefficients of variation of land per household, draft animals per household, and beginning-of-year net indebtedness per household. (3) The *employee's household assets* are described by his household's landholding, the number of draft animals it owns, its beginning-of-year net indebtedness, and the number of household dependents. (4) The *employer's household assets* are described by the same four variables.

Several observations from table 7 are noteworthy. First, household assets have small and generally insignificant effects on a contract's permanent wage. These results are consistent with the view that the equilibrium permanent wage equation in the hedonic model is neither monotonic in standardized debt nor influenced by individuals' household assets. Household assets may influence an individual worker's and employer's contract choices but should not influence the equilibrium permanent wage. If the level of standardized debt and human capital attributes are taken as given, the equilibrium permanent wage is determined by aggregate market conditions in the village economy. On the other hand, aggregate conditions should not influence individuals' payoffs and, hence, not affect individuals' marginal bid and offer prices for standardized debt. In terms of the hedonic model notation and estimation, we implement these ideas by including the human capital and village variables in $\mathbf{X}_v$ and $\mathbf{Z}_v$ but

TABLE 7

ORDINARY LEAST SQUARES REDUCED-FORM ESTIMATES

	Log Permanent Wage	Standardized Debt
Human capital:		
Agricultural skilled	.054	.883
	(.094)	(2.233)
Agricultural semiskilled	−.036	1.047
	(.081)	(1.926)
Agricultural unskilled	−.758	6.800
	(.112)	(2.661)
Nonagricultural skilled	.183	−4.301
	(.161)	(3.814)
Age	.123	.041
	(.011)	(.254)
Age^2	−.0015	−.000077
	(.00014)	(.0034)
Household farms	−.191	−1.481
	(1.08)	(2.562)
Household landless, doesn't farm, hires out agricultural	−.228	−1.185
	(.105)	(2.491)
Tenure	−.023	−.395
	(.027)	(.395)
Village variables:		
Land per household	.0119	−.222
	(.002)	(.056)
Draft animals per household	−.028	−20.639
	(.141)	(3.346)
Farm implements per household	.157	7.830
	(.159)	(30.099)
Land quality	3.168	−57.05
	(1.270)	(3.762)
Percentage nonagricultural households	.041	−.460
	(.007)	(.172)
Coefficient of variation of land per household	1,442.15	19,825.30
	(834.006)	(19,778.34)
Coefficient of variation of draft animals per household	−.119	1.522
	(.109)	(2.591)
Coefficient of variation of indebtedness	−74.36	−867.408
	(63.579)	(1,507.774)
Employee household assets:		
Land	.001	.046
	(.001)	(.026)
Draft animals	.0093	−3.10
	(.064)	(1.522)
Indebtedness	.00004	.007
	(.00007)	(.0016)
Dependents	.034	.632
	(.019)	(.456)
Employer household assets:		
Land per household	−.00003	.0098
	(.0001)	(.0032)
Draft animals per household	.0098	.391
	(.0089)	(.211)
Indebtedness	.000087	.0006
	(.000045)	(.0011)
Dependents	.0192	.994
	(.0092)	(.220)

NOTE.—For compactness, we have excluded instruments involving the interaction of the coefficients of variation of land, draft animals, and indebtedness with each of the employer and employee assets. Standard errors are in parentheses.

not in $\{\mathbf{Y}_v^d, \mathbf{Y}_v^s\}$, while including the employee (employer) household assets in $\mathbf{Y}_v^d$ ($\mathbf{Y}_v^s$) but not in $\{\mathbf{X}_v, \mathbf{Z}_v\}$.

Second, the coefficients of employee and employer household assets from the reduced form for standardized debt are roughly consistent with the view that wage profiles are designed, in part, to facilitate an implicit exchange of credit between them. Standardized debt is an increasing (decreasing) function of the employer's (worker's) household assets.

The third important observation is that the reduced-form equations are entirely mute concerning incentive problems, reputation, and matchmaking. The reason is that the latter features of the contracting problem are captured by the influence of other endogenous contracting variables, principally, whether or not there is a third party to the contract and whether or not the contract is made between residents of the same village. On these matters, the exogenous variables are silent. The only way to uncover incentive problems is to estimate the demand and supply equations, with $\{T_v, S_v\}$ as explanatory variables, jointly with the wage equation. Solving demand for and supply of standardized debt and the marginal price of debt, D_v and $-dw_v/dD_v$, does not get around the problem because, as indicated earlier, the marginal price equation would have to be estimated jointly with the hedonic wage equation. While the structural hedonic model is more complex than the pair of equations described in table 7, it is also more informative since it allows us to directly test the alternative hypotheses described in table 6 concerning credit and job-related incentive problems.

As a follow-up to the earlier discussion of admissible instruments for the structural model, the instrument list for the wage equation includes all the variables listed in table 7, the squares of all household assets, plus the interactions of the three coefficients of variation with each of the household assets. The instrument list for the demand equation is the same except that the employer's household assets, their squared values, and their interactions with the coefficients of variation are all excluded. The instrument list for the supply equation is the same as for the wage equation except that the employee's human capital and household assets, their squared values, and their interactions with the coefficients of variation are all excluded.

VII. Findings

This section describes our main empirical results, excluding those pertaining to reputational costs; the latter material is relevant only for incentive problems and is presented in Section VIII. We focus our discussion on the set of parameter estimates reported in tables

8–10 from different full-system specifications, that is, (5)–(6). The demand and supply parameters in tables 9 and 10 are of special interest since they allow us to examine critically the competing predictions summarized in table 6.

A. *The Wage Equation*

Table 8 presents system estimates of two different wage equations. In column A, standardized debt and debt squared interact with three village-level variables. In column B, debt is also interacted with the same-village and third-party dummy variables, yielding $D*S$ and $D*T$, and each is interacted with the same three village-level variables. The latter equation allows both intervillage and intravillage variation in the marginal price of standardized debt. The wage equation in column A (B) of table 8 was estimated jointly with the demand and supply equations described, respectively, in column A1 (B1) of tables 9 and 10 below. The instrument list for each equation is described at the end of Section VI.

Human capital.—Variables describing the worker's human capital perform largely as expected. First, relative to semiskilled nonagricultural workers, skilled nonagricultural workers receive the largest premium, skilled agricultural workers receive the second-largest, semiskilled agricultural workers are paid a small negative premium, and unskilled agricultural workers are the lowest-paid. The skill differentials are also substantial: the most skilled workers' permanent wage is over twice as large as that of the least skilled workers.

Second, the worker's age is a significant determinant of his permanent wage. The age-earnings profile is upward sloping to about 40 years and declines thereafter.

Third, the worker's family background is important. Two household activity dummy variables capture the following three possibilities: (i) the worker's family farms either its own or rented land; (ii) the worker's family is landless and does not farm, but hires out as agricultural workers; and (iii) the worker's family is landless, does not farm, may operate a nonagricultural enterprise, and hires out members as nonagricultural workers. The pattern of coefficients shows that some forms of marketable human capital (e.g., farm management or nonagricultural skills) are acquired at home that are not captured by the formal skill categories considered above.

Finally, the small negative effect of tenure on a worker's current permanent wage suggests that job-specific human capital is unimportant. In turn, this observation is consistent with the general absence of multiyear employment relationships; the average tenure of the working relationship between the parties to the contracts in our sample, excluding the sample period itself, was 0.24 year.

TABLE 8

HEDONIC EQUATION FOR LOG PERMANENT WAGE

	A	B
Intercept	1.173	.636
	(1.859)	(1.893)
Human capital:		
Agricultural skilled	.179	.118
	(.093)	(.097)
Agricultural semiskilled	.116	.232
	(.094)	(.099)
Agricultural unskilled	−.632	−.640
	(.120)	(.121)
Nonagricultural skilled	.407	.538
	(.128)	(.138)
Age	.128	.124
	(.011)	(.011)
Age^2	−.016	−.0015
	(.00014)	(.00014)
Household farms	−.362	−.363
	(.126)	(.130)
Household landless, doesn't farm, hires out agricultural	−.405	−.340
	(.123)	(.126)
Tenure	−.046	−.032
	(.021)	(.021)
Submarkets:		
Both villagers (S)	−.128	−.182
	(.011)	(.072)
Third party (T)	−.012	.0068
	(.114)	(.112)
Village variables:		
Land per household	.020	.021
	(.0016)	(.0016)
Draft animals per household	.141	.194
	(.125)	(.127)
Farm implements per household	−.249	−.146
	(−.117)	(.117)
Land quality	.593	1.524
	(1.309)	(1.312)
Percentage nonagricultural households	.047	.050
	(.0050)	(.0052)
Contract timing:*		
PROD2	−2.233	−2.028
	(.816)	(.845)
PROD3	.418	.367
	(.156)	(.161)
PROD4	−.032	−.027
	(.013)	(.013)
PROD5	.00088	.00075
	(.00038)	(.00039)
$T_e - T_b$	−.022	.021
	(.092)	(.089)
$(T_e - T_b)^2$	.0042	−.00069
	(.0065)	(.0065)

TABLE 8 (*Continued*)

	A	B
Village weights on debt:		
Coefficient of variation of land	21.936	−6.475
	(6.125)	(3.584)
Coefficient of variation of draft animals	−.286	−.086
(×100)	(.079)	(.069)
Coefficient of variation of indebtedness	1.132	.765
	(.540)	(.890)
Village weights on debt × T:		
Coefficient of variation of land		.0063
		(25.922)
Coefficient of variation of draft animals		.55
(×100)		(.36)
Coefficient of variation of indebtedness		−5.065
		(4.764)
Village weights on debt × S:		
Coefficient of variation of land		23.093
		(8.372)
Coefficient of variation of draft animals		−.19
(×100)		(.12)
Coefficient of variation of indebtedness		−.457
		(1.394)
Village weights on debt^2:		
Coefficient of variation of land	3.107	1.575
	(.723)	(.345)
Coefficient of variation of draft animals	−.040	−.012
(×100)	(.0095)	(.0028)
Coefficient of variation of indebtedness	.342	.362
	(.078)	(.081)
R^2	.57	.56
S_e	.54	.55

NOTE.—Robust-White standard errors are in parentheses.
* PRODi = $(T_e^i - T_b^i)/(T_e - T_b)$.

Submarkets.—Dummy variables indicating when the contracting parties are from the same village (S) and when there is a third party (T) are entered additively in all wage equations. Both are endogenous and instrumented in this equation and in the demand and supply equations below. The negative S coefficient and insignificant T coefficient are consistent with the view that the level of wages partially offsets workers' intervillage mobility costs.

Village variables.—Five village-level variables appear additively in each wage equation to capture cross-village variations in market conditions; for each of the 21 surveyed villages, a village-level variable represents an average of conditions in the surveyed village and four to six surrounding villages. Average landownership per household has a significant positive effect on the permanent wage, as does the percentage of households whose primary source of income is nonagricultural activities. Average ownership of draft animals per house-

hold and average land quality (measured using tax data) also have positive effects on the wage. Since some households hire in workers while others in the same villages hire out workers, these positive effects can all be rationalized as working through some combination of increased demand for and decreased supply of labor. Curiously, average household ownership of farm implements has a negative effect on the wage.

Contract timing.—Recognizing that productivity may be higher in the planting and harvesting periods, we suppose that a worker's productivity at time t equals $2a_1t + 3a_2t^2 + 4a_3t^3 + 5a_4t^4$, so that average productivity over the course of a contract that begins at T_b and ends at T_e is equal to

$$a_1 + a_2\frac{T_e^2 - T_b^2}{T_e - T_b} + a_3\frac{T_e^3 - T_b^3}{T_e - T_b} + a_4\frac{T_e^4 - T_b^4}{T_e - T_b} + a_5\frac{T_e^5 - T_b^5}{T_e - T_b}.$$

In table 8, PRODi denotes $(T_e^i - T_b^i)/(T_e - T_b)$, for $i = 2, \ldots, 5$. Contract duration and timing as captured by the PRODi variables have significant effects on the permanent wage; however, contract duration by itself, $T_e - T_b$, measured independently of $\{\text{PROD}i\}_{i=1}^4$, has no significant effect.[32]

Standardized debt.—The three village-level variables that are interacted with debt and debt squared in columns A and B are the coefficient of variation of indebtedness per household at the beginning of 1935, the coefficient of variation of landholdings per household, and the coefficient of variation of draft animals per household. Coefficients of variation rather than per capita values are used to aid in the identification of demand and supply coefficients (see Sec. VI). Most of the coefficients are significant. In terms of the resulting quadratic in debt from column A, $\beta_{2v}D + \beta_{3v}D^2$, the estimates indicate that 15 villages satisfy $\beta_{2v} > 0$ and $\beta_{3v} < 0$, three villages satisfy $\beta_{2v} > 0$ and $\beta_{3v} > 0$, and three villages satisfy $\beta_{2v} < 0$ and $\beta_{3v} > 0$. The estimates in column B describe four quadratics per village, yielding four marginal price functions corresponding to the markets for contracts between villagers and nonvillagers, with and without a third party. When villages and village submarkets are compared, the corresponding coefficients of D and D^2 exhibit all possible combinations of signs.

B. *Worker's Demand Equation*

Table 9 reports estimates of the parameters of four different worker demand equations for standardized debt; each parameter set arises

[32] Since T_b and T_e are endogenous, the PRODi, $T_e - T_b$, and $(T_e - T_b)^2$ are all instrumented in all the equations in which they appear.

TABLE 9

DEMAND FOR STANDARDIZED DEBT

Demand	A1	A2*	A3	B1
Intercept	.494	2.451	4.563	4.666
	(7.054)	(10.190)	(8.337)	(4.975)
Slope	−9,663.24	−14,295.8	−10,054.9	−4,768.46
	(3,446.43)	(7,697.85)	(3,303.98)	(1,361.61)
Initial assets:				
Land	.098	−.070	.111	−.049
	(.075)	(.056)	(.078)	(.034)
Draft animals	−2.062	−3.674	−2.826	−1.465
	(1.068)	(2.336)	(2.141)	(1.460)
Indebtedness	.066	.082	.087	.019
	(.017)	(.061)	(.019)	(.0063)
Number of dependents	.081	.857	.881	.424
	(.564)	(.659)	(.658)	(.470)
Credit transactions:				
Net borrowing in 1935	−.157	.094	−.142	.063
	(.074)	(.063)	(.076)	(.036)
Contract variables:				
Both villagers (S)	−5.065	−10.161	−7.590	−7.288
	(4.600)	(7.160)	(5.448)	(3.313)
Third party (T)	−15.908	−9.358	−20.912	−17.994
	(5.383)	(5.631)	(5.403)	(4.489)
Duration ($T_e - T_b$)	3.821	2.462	3.610	4.705
	(2.600)	(3.832)	(3.072)	(1.691)
Duration^2	−.331	−2.02	−3.610	−.343
	(.190)	(.263)	(3.072)	(.119)
Permanent wage			−8.652	
			(2.445)	
R^2	.02	.20	.03	.08
S_e	15.30	12.61	16.10	14.62

NOTE.—Robust-White standard errors are in parentheses.
* Coefficients of household assets for villagers only.

from a different full-system specification. The equation described in column A1 (B1) of table 9 was estimated jointly with the wage equation in column A (B) of table 8 and the supply equation in column A1 (B1) of table 10 below; the equation described in column A2 (A3) of table 9 was estimated jointly with the supply equation in column A2 (A3) of table 10 and a wage equation whose structure is the same as that described in column A of table 8.

Slope.—The demand curve is downward sloping, and the slope parameter is highly significant. Evaluated at the sample mean attributes of workers and the mean value of standardized debt, the price elasticity of demand corresponding to the equation in column A2 is −.91. As the marginal price of standardized debt increases—that is, as the marginal reduction in the permanent wage becomes larger—workers demand less standardized debt and choose contracts with payments shifted away from the beginning and toward the end of the contract. According to table 6, this result is an implication of worker credit

problems; it effectively rules out pure worker incentive problems with terminations (which prescribe upward-sloping demand curves) but is not inconsistent with some employer malfeasance problems.

Household assets.—Four beginning-of-year household assets are included: holdings of land and draft animals, net real indebtedness at the beginning of 1935, and the number of dependents. The latter number includes household members who either work within the household on narrowly defined home production (e.g., grandparents) or do not work at all (e.g., children).

Detailed information on a worker's household is available only for those contracts that involve a worker from one of the 21 surveyed villages. For those workers who contracted with an employer from the ith surveyed village but whose families lived elsewhere, we assigned the mean values of the household assets of those families in village i that had members who hired out on 1–12-month contracts in 1935. In column A2 alone, a distinction is made between the household assets of workers whose families reside in one of the surveyed villages and those of workers whose families reside elsewhere; in column A2, the rows listed as initial assets report the estimated coefficients of each household asset interacted with the same-village dummy variable S.[33]

Across all the columns in table 9, a worker's demand for standardized debt is a decreasing function of his household's holdings of draft animals, an increasing function of his household's beginning-of-year indebtedness, and an increasing function of the number of dependents. The indebtedness variable is the only exogenous measure of a household's financial position and is the only variable that has a consistently significant coefficient. The disappointing performance of the land variable may be a consequence of the fact that a number of workers are from landless households.[34]

Credit transactions.—Net household borrowing during 1935 is also included as a right-hand-side variable. This household-level variable is an endogenous variable that is chosen contemporaneously with

[33] The corresponding coefficients of the mean worker-household assets when the contracting parties are from different villages have no interesting implications for demand and are omitted from the table.

[34] The impact of household assets on workers' contract choices is illustrated with the following example. Consider a 26-week contract with only two payments, w_0 and w_{26}, at the very beginning and end. Suppose that $r = 0$ and $y = 1$, so that $w_0 + w_{26} = 26$ and $D = w_0 - 12.5$. If a worker's household holdings of land and draft animals are both increased by one sample standard deviation (based on the sample of worker households), the coefficients in col. A2 indicate that the worker's demand for debt will fall by 7.32. If we start at $D = 0$, where $w_0 = 12.5$ and $w_{26} = 13.5$, this asset change induces the worker to opt for a much steeper wage profile, with $w_0 = 5.2$ and $w_{26} = 20.8$.

household members' employment contracts. If workers from households that are credit constrained choose contracts to borrow implicitly from their employers, net household borrowing during 1935 should be correlated with the residual in the demand for standardized debt equation. Thus, along with each of the contract variables listed in table 9, net household borrowing during 1935 is instrumented in all four reported equations.

The theoretical analysis in Section V does not formally consider household borrowing. Extending that analysis, we can describe a worker's demand for implicit borrowing conditional on his household's explicit borrowing by modeling changes in household borrowing as endowment changes. If a worker's demand for standardized debt has a credit component, the sign of the coefficient of net household borrowing in the demand equation is ambiguous since it depends on whether net household borrowing is modeled as primarily affecting endowments toward the beginning or end of a contract. If, on the other hand, demand has no credit component and workers are unconstrained in the credit market, the coefficient of net household borrowing in the demand equation should equal zero. Thus, while a significant coefficient of net household borrowing is consistent with the existence of a credit problem, an insignificant coefficient does not rule this possibility out. The coefficients of net household borrowing during 1935 reported in table 9 are all significant but have different signs.

Overall, the significant negative slope coefficient, the household asset results, and the significant net household borrowing coefficient together confirm the demand side of the credit problem hypothesis; that is, contractual wage profiles serve in part to effect loans between workers and employers.

Contract duration.—Over the 1–6-month range, workers who opt for longer contracts demand more debt; over the 6–12-month range, this effect is reversed.

Permanent wage.—In column A3, a larger permanent wage decreases a worker's demand for debt. That is, as the overall level of wages rises, the amount a worker is willing to pay to shift payments toward the beginning of the contract decreases. This result provides further support for the view that liquidity constraints partially underlie workers' preferences concerning wage profiles.

As to incentive issues, it can be shown that the pure worker-shirking model with termination contracts also predicts that the coefficient of the permanent wage in the demand equation should be negative, whereas the corresponding pure employer incentive problem model predicts a positive coefficient. We earlier noted that the negative slope of demand is inconsistent with the former hypothesis; we now observe

TABLE 10

SUPPLY OF STANDARDIZED DEBT

Supply	A1	A2*	A3	B1
Intercept	−2.737	5.855	4.318	−6.971
	(3.158)	(3.347)	(3.855)	(4.542)
Slope	1,400.37	3,699.94	1,402.11	990.834
	(338.517)	(1,837.60)	(346.00)	(244.751)
Initial assets:				
Land	.0041	.0084	.0049	.010
	(.0012)	(.0021)	(.0013)	(.0019)
Draft animals	.418	−.0080	.447	.780
	(.102)	(.132)	(.100)	(.132)
Indebtedness	−.0120	−.0014	−.014	−.014
	(.0026)	(.0030)	(.0026)	(.0032)
Number of dependents	−.556	−.745	−.644	−1.724
	(.076)	(.195)	(.077)	(.185)
Credit transactions:				
Net borrowing in 1935	.0038	−.018	.0053	.030
	(.0062)	(.015)	(.95)	(−.0083)
Contract variables:				
Both villagers (S)	−.646	.045	−.421	−3.907
	(1.924)	(1.074)	(1.941)	(2.363)
Third party (T)	4.272	2.974	3.923	4.041
	(1.807)	(1.559)	(1.859)	(2.714)
Duration ($T_e - T_b$)	1.212	−.607	−1.083	4.631
	(1.268)	(1.114)	(1.472)	(1.604)
Duration^2	−.087	−.0082	.068	−.318
	(.090)	(.079)	(.103)	(.110)
Permanent wage			−.786	
			(.600)	
R^2	.04	.13	.02	.15
S_e	26.07	13.25	21.31	12.81

NOTE.—Robust-White standard errors are in parentheses.
* Coefficients of household assets for villagers only.

that the negative coefficient of the permanent wage in the demand equation is inconsistent with the latter hypothesis.

C. *Employer's Supply Equation*

Table 10 reports parameter estimates from several employer supply equations for standardized debt. These equations have the same format as the demand equations.

Slope.—The supply curve is upward sloping. Increasing the permanent wage reduction associated with an increase in a contract's standardized debt induces employers to supply contracts with more standardized debt. Evaluated at the sample mean of employers' attributes and the mean value of standardized debt, the price elasticity of the supply equation in column A2 equals 1.86. A positive slope is an implication of employer credit problems and some worker incentive

problems. It rules out pure employer incentive problems with terminations that prescribe downward-sloping supply curves.

Household assets.—Asset effects on the supply side of the market are uniformly consistent and significant. The supply of standardized debt is an increasing function of an employer's holdings of land and draft animals and a decreasing function of the employer's net indebtedness at the beginning of the year and his number of dependents.[35] Recall that these asset effects *cannot* be attributed to a pure incentive problem. According to the models of job-related incentive problems described earlier in Section V and summarized in table 6, the employer's assets will affect supply only to the extent that they affect worker productivity, but in this case, greater asset holdings will decrease (rather than increase) the supply of standardized debt.

Credit transactions.—Net employer household borrowing during 1935 is also included as a right-hand-side variable in the supply equations. As in the case of demand, this household-level variable is an endogenous variable that is instrumented in all four reported equations. Concerning its coefficient, an argument analogous to that made earlier for demand can be made here: a significant coefficient of net household borrowing in a supply equation is evidence of a credit component in employers' supplies of standardized debt, but an insignificant coefficient does not rule out this possibility. With the exception of equation B1, the coefficients of net household borrowing during 1935 reported in table 10 are all insignificant.

Permanent wage.—The permanent wage has a small and relatively insignificant effect on an employer's supply of standardized debt.

VIII. Incentive Problems

Household credit considerations have substantial and predictable effects on the payment profiles that employers and workers choose. Still, job-related incentive effects cannot be ruled out. In this section we verify that incentive problems are important and that workers are the primary source of these problems. There is also some evidence that firing may not be a widely used instrument for attenuating shirking. In the absence of terminations, reputational concerns are especially important for disciplining workers.

[35] When an employer's holdings of household land and draft animals are both increased by one sample standard deviation (based on the sample of employer households), the coefficients in col. A2 indicate that the supply of debt increases by 5.11. On a 26-week contract, with $r = 0$, $y = 1$, and initial and final payments $\{w_0, w_{26}\}$, starting at $D = 0$ and increasing D by 5.11 raises w_0 from 12.5 to 17.6 and lowers w_{26} from 13.5 to 8.4; thus a negatively sloped wage profile results.

A. Reputational Costs

The third party to an employment contract is usually a widely known and respected individual. Since the roles played by the third party were not recorded by the surveyors, we propose two nonexclusive alternatives. As a matchmaker, a third party brings potential trading partners together. More specifically, when an attribute of one party is privately known but affects the other's payoff, a third party screens candidates and so helps resolve the hidden information problem. That is, the presence of a third party signals superior worker productivity, superior working conditions, or both. From table 6, superior worker productivity affects only employers: it causes the supply curve to pivot about a small positive debt value (corresponding to a flat wage profile) and makes the supply curve become flatter but leaves demand unchanged. Likewise, superior working conditions affect only workers: they cause the demand curve to pivot about $D \approx 0$ and become flatter but leave the supply curve unchanged.

Alternatively, the third party may act as an enforcement device that ensures that penalties are imposed on employees or employers for shirking. This penalty may be imposed either directly by the third party or, through communication of this behavior to other agents, by the local community. In this case, the third party helps resolve a hidden action problem. Under this alternative hypothesis, the third-party dummy variable, T, is a proxy for enhanced reputational costs. Since enhanced reputational costs affect both parties' payoffs, they will affect demand *and* supply, as recorded in table 6. In turn, these reputational effects are present only when incentive problems motivate individuals' contract choices.

The same-village dummy variable, S, identifies contracts for which both parties reside in the same village. Arguably, this variable can also have matching and enforcement implications and can likewise be used to test for incentive problems. When both parties to a contract reside in the same village, each is likely to know more about his partner (and have selected accordingly) than he would know about agents from other villages. Also, when the worker and the employer (and their families) live in the same village, it should be easier for their shared community to monitor opportunistic behavior and impose sanctions.

The third-party and same-village variables are allowed to affect both the intercepts and slopes of the demand and supply functions. Specifically, the basic linear relationship between standardized debt and price, $D = a + bp$, is replaced by

$$(1 + \xi_1 T + \xi_2 S)D = a + \alpha_1 T + \alpha_2 S + \alpha_3 \Delta T + \alpha_4 \Delta S + bp,$$

TABLE 11

PREDICTED EFFECTS OF T AND S ON DEMAND AND SUPPLY

Worker incentive problems:		
Mixed; no termination	$\xi_i^d > 0, \alpha_i^d \approx 0$	$\xi_i^s < 0, \alpha_i^s \approx 0$
Pure; full termination	$\xi_i^d > 0, \alpha_i^d < 0$	$\xi_i^s < 0, \alpha_i^s > 0$
Mixed; full termination	$\xi_i^d > 0, \alpha_i^d \approx 0$	$\xi_i^s < 0, \alpha_i^s > 0$
Employer incentive problems:		
Mixed; no termination	$\xi_i^d < 0, \alpha_i^d \approx 0$	$\xi_i^s > 0, \alpha_i^s \approx 0$
Pure; full termination	$\xi_i^d < 0, \alpha_i^d < 0$	$\xi_i^s > 0, \alpha_i^s > 0$
Mixed; full termination	$\xi_i^d < 0, \alpha_i^d < 0$	$\xi_i^s > 0, \alpha_i^s \approx 0$
Matchmaker:		
Worker productivity	$\xi_i^d = \alpha_i^d = 0$	$\xi_i^s < 0, \alpha_i^s \approx 0$
Working conditions	$\xi_i^d < 0, \alpha_i^d \approx 0$	$\xi_i^s = \alpha_i^s = 0$

NOTE.—Demand and supply take the general form

$$(1 + \xi_1 T + \xi_2 S)D = \alpha + \alpha_1 T + \alpha_2 S + \alpha_3(T_e - T_b)T + \alpha_4(T_e - T_b)S + bp,$$

where T denotes third party, S denotes same village, D is standardized debt, T_e (T_b) is the starting (ending) date of the contract, and p is the marginal price.

where $\Delta = T_e - T_b$ denotes contract duration; the slope is now given by $(1 + \xi_1 T + \xi_2 S)/b$. Duration is interacted with T and S to allow the importance of matching and enforcement functions to vary with contract length. Table 11 describes the different incentive matching hypotheses developed in Section V, and summarized in table 6, in terms of their implications for the signs of $\{\xi_i^d, \alpha_j^d\}$ and $\{\xi_i^s, \alpha_j^s\}$ in the demand ($b < 0$) and supply ($b > 0$) equations, respectively. Table 12 reports full-system estimates of these parameters.[36]

Before we describe the results, a brief comment on some of the entries concerning incentive problems in table 11 is appropriate. Since credit problems have been confirmed for both contracting parties, we can test for whether or not incentive problems are also important by considering only the predictions of "mixed" problems. Earlier, we explicitly solved the mixed credit incentive problem with no-termination ($\lambda = 0$) contracts. In this case, enhanced reputational costs cause both the demand and supply curves to pivot about a small positive D value; the intersection of demand and supply with the marginal price axis is largely unaffected by enhanced reputational costs and hence is modeled by $\alpha_j^k \approx 0$. According to the matching model, the presence of a matchmaker causes only one of these two curves to pivot.

With full-termination ($\lambda = 1$) contracts and pure incentive problems, enhanced reputational costs decrease the marginal bid and of-

[36] Except for these additional terms, the wage equation and the demand and supply equations have the same right-hand-side variables as those listed in cols. A and A1 of tables 8–10.

TABLE 12

ESTIMATED EFFECT OF T AND S ON DEMAND AND SUPPLY

	1	2	3	4
Demand parameters:				
α_1^d	−15.908	5.293	−8.870	32.621
	(5.383)	(8.910)	(2.383)	(19.619)
α_2^d	−5.065	−14.328	53.215	−16.845
	(4.600)	(7.412)	(66.672)	(6.898)
α_3^d		−2.687		−7.421
		(.974)		(4.208)
α_4^d		1.520		1.560
		(.768)		(.874)
ξ_1^d			.464	−.061
			(.181)	(.071)
ξ_2^d			27.132	20.738
			(30.951)	(21.695)
Supply parameters:				
α_1^s	4.273	22.750	−1.335	8.712
	(1.807)	(5.995)	(.981)	(3.150)
α_2^s	−.647	9.961	−.181	−3.681
	(1.924)	(5.535)	(.835)	(2.903)
α_3^s		−3.058		−1.140
		(.743)		(.366)
α_4^s		−1.573		.101
		(.649)		(.495)
ξ_1^s			−.483	−.746
			(−.117)	(.023)
ξ_2^s			−.553	−.426
			(.105)	(.065)

fer prices for each value of standardized debt (see table 6). In the case of a worker incentive problem, the reduction in the marginal bid price becomes smaller as the incentive effect provided by D becomes stronger, that is, as D decreases. For an employer incentive problem, the reduction in the marginal offer price also becomes smaller as the incentive effect provided by D is enhanced, but in this case, as D increases. The pure, full-termination entries in table 11 describe the implications of superimposing these pure incentive effects on downward-sloping demand and upward-sloping supply curves, which otherwise reflect underlying credit problems.

The mixed case with full-termination contracts has not yet been formally solved. Nevertheless, we can infer its main properties with respect to reputational effects by comparing the MRSs for the different situations that have been solved. In the case of worker incentive problems, a comparison of u_0/u_2 in equations (3′) and (4) indicates that the effect of enhanced reputational costs on demand is essentially the same as in the mixed no-termination case. Hence the mixed full-termination demand entry in table 11 is the same as the mixed no-

termination entry. A comparison of v_0/v_2 in (4) with the corresponding expression from the pure worker incentive model,

$$\left\{p(h_0^*) - [\alpha + (\alpha h_2^* - w_2)p'(h_0^*)]\frac{dh_0^*}{dw_2}\right\}^{-1},$$

indicates that the effect on supply closely mirrors the pure full-termination results. Hence the mixed full-termination supply entry in table 11 is the same as the pure full-termination entry. Correspondingly, in the case of employer incentive problems, the effect of enhanced reputational costs on demand matches the pure full-termination results, and their effect on supply follows the mixed no-termination case.

Tables 9 and 10 show that when T and S are introduced only additively, the presence of a third party generally has a negative effect on demand and a positive effect on supply, whereas contracting with someone from the same village has a negative effect on demand and hardly any effect on supply. The coefficients in column 1 of table 12 were reported earlier in column A1 of tables 9 and 10. The slope effects in columns 3 and 4, by contrast, are revealing.

Columns 3 and 4 show that the supply functions for standardized debt in the markets for contracts having a third party or between residents of the same village are flatter than otherwise. With reference to table 11, this effectively rules out employer incentive problems as a primary concern but fails to distinguish between a worker incentive problem and a matching model with privately known worker attributes. Observe also that these slope coefficients are the only supply-side parameters in columns 3–4 that are significantly different from zero. These "pivoting" results support the worker-related, no-termination, incentive-matching hypotheses and cast doubt on the importance of full-termination contracts with worker incentive problems.

The positive third-party slope parameters on the demand side confirm that the third party's primary role is to act as an enforcement device (to impose reputational costs) in the case in which workers shirk. By contrast, the same-village slope parameters on the demand side are insignificantly different from zero. Overall, the same-village coefficients in the demand and supply equations in columns 3 and 4 offer some support for the matchmaking view that employers are more informed concerning the attributes of workers from the same villages, and so within-village matching is not entirely random.

The same-village results may be less compelling than the third-party results, in part, because geographic boundaries do not generally impede information flows; that is, a worker and employer who are

identified as residing in different villages may still live close enough to generate enhanced information or reputational costs. Nevertheless, it is clear that S and T have different effects on demand and supply. Indeed, a puzzling observation from columns 2 and 4 is that the demand for standardized debt on contracts with a third party is a decreasing function of contract length whereas demand on contracts between villagers increases with contract length.

B. *Alternative Wages*

A worker's alternative wage toward the end of an employment contract is an *explicit* determinant of the demand for and supply of that contract's standardized debt only when a worker incentive problem exists *and* terminations are used (see table 6). The reason is that higher alternative wages decrease a worker's expected cost of shirking when terminations are used and hence decrease his initial effort level. Since higher alternative wages are equivalent to attenuated reputational costs, alternative wages are expected to have an ambiguous effect on demand and a negative effect on supply (see table 11). Estimating the effect of alternative wages on demand and supply thus becomes an alternative means of jointly confirming an incentive problem and terminations.

The survey from which our data are drawn did not collect information on workers' alternative wages. Hence some other measure of labor market activity must be employed. We experimented with several and report on two here. If variations in employment over time are due primarily to labor demand shifts, the volume of employment and level of wages in the market will move together. In this case, a measure of aggregate employment at a point in time can proxy for the alternative (permanent) wage at that time. The two different measures of aggregate employment we consider are denoted by $N3(t)$ and $N6(t)$ and represent the numbers of workers employed at time t on contracts of 1–3 and 1–6 months' duration, respectively. These numbers are plotted in figure 1.

For a contract that begins at time T_b and ends at time T_e, $N3(T_e)$ and $N6(T_e)$ are measures of the state of the village labor market at the end of that contract. Using the system described by column A in table 8 and column A3 in tables 9 and 10 (in which the permanent wage appears in the demand and supply equations), we estimated a system with $N3(T_e)$ as an additional determinant of demand and supply and another system with $N6(T_e)$. In the demand and supply equations of these full-system estimates, the coefficients of $N3(T_e)$ are insignificant and the coefficients of $N6(T_e)$ are both positive and significant. The overall pattern of the remaining coefficients does not change substantially compared to those reported in column A3.

Figure 1 shows that the $N3(t)$ series exhibits hardly any variation over the first six months of the year. The $N6(t)$ series is both more variable and more interesting because it is consistent with an expected pattern of market wages that is driven by an agricultural cycle. In particular, we expect a worker's alternative wage to be highest in the planting and harvesting periods and to bottom out sometime during the least active period, the winter. In this sense, $N6(t)$ may be a good proxy for workers' alternative wages.

In the previous section we confirmed that worker incentive problems influenced contract choices and offered some evidence that, even implicitly, termination clauses were unimportant. In this section we argued in the context of a worker incentive problem that a worker's alternative wage can affect demand and supply only if terminations are important. Given that the predicted impact is uncertain in the case of demand and negative in the case of supply, how should we interpret the positive impacts of $N6(T_e)$ on demand and supply?

Suppose that a worker's alternative potential trading partners' inclinations to impose sanctions, following shirking, vary inversely with their own demands for labor. In this case, $N6(T_e)$ will be negatively correlated with the reputational cost of shirking during the latter part of a contract. That is, $N6(T_e)$ is interpreted to be an inverse measure of certain reputational costs, which we earlier denoted by R_{n2} and R_{s2}, rather than a proxy for alternative wages. According to this interpretation, increasing $N6(T_e)$ will decrease reputational costs and so decrease the second-period level of effort, h_2^*, in models without terminations; from (3′), decreasing h_2^* increases workers' bid price and decreases employers' offer price. Thus positive coefficients are anticipated in a mixed credit and worker incentive problem without terminations.

IX. Final Remarks

In this paper we developed and estimated a structural principal-agent model of employment contracts in order to evaluate the roles of credit and incentive issues in the design of rural labor contracts from the 1930s. The econometric evidence indicates that workers' and employers' contract choices were influenced by their household asset endowments in a manner consistent with the view that participants on both sides of the labor market had limited access to the credit market. It also indicates that shirking by workers was the dominant incentive issue and suggests that reputation rather than termination was the primary worker-disciplining device. In this setting, then, there does not appear to have been a trade-off between credit and incentives in the design of payment profiles. Our empirical results also indicate that the introduction of a third party to these employment contracts

enhanced the reputational cost of shirking and being caught, whereas employers' decisions to hire workers from their own villages seem to have been motivated by informational rather than incentive considerations.

To place the credit exchanged through labor contracts in context, we compared the total amount of borrowing and lending by villagers implicitly through the labor market (determined when calculating D for each contract) with that explicitly through the credit market. The latter estimates were based on data for all 1,049 households in the 21 villages and cover all such transactions in 1935, including credit exchanged with nonvillagers. It is interesting that the amounts of implicit and explicit credit were not too different.[37] Having identified implicit credit exchange through labor contracts as a motive for individuals' contract choices and as quantitatively important in the aggregate, we hope in future work to explain why, at an individual level, some households rely more on one form of credit than on the other and why, in the aggregate, some village economies exhibit more of one form of credit than of the other.

Appendix

Labor Contract Variables

1. Name and residency of the employer and worker
2. Kind of work to be done, as defined by one of three skill categories for agricultural jobs and two for nonagricultural jobs
3. Age of the employee
4. Starting and ending dates of the contract
5. Number of years the employee worked for the employer
6. Cash wages paid to the employee and the payment dates
7. In-kind payments to the employee (excluding meals and accommodations) and the payment dates
8. Relationship between the contracting parties, specifically whether or not their households (i) reside in the same village or (ii) are members of the same extended family (or both)

[37] Credit totaling 10,428 yuan was extended implicitly via labor contracts, and households lent 8,025 yuan in the informal credit market (informal credit is the term used to describe borrowing and lending between two individuals, whereas formal credit entails borrowing from financial intermediaries). The sums lent and borrowed, whether implicit or explicit, are not equal because of transactions between residents of the 21 villages and agents outside of these villages. Households borrowed 9,114 yuan implicitly and 28,833 yuan on the informal credit market. The implicit lending and borrowing reported here are lower bounds since they are derived from 583 of the 750 employment contracts among households in the village sample.

9. Whether or not there is a third party to the contract
10. Employee's family background: the family (i) does not farm or own land and earns its livelihood primarily by hiring out in agriculture, (ii) farms either its own or rented land but also hires out, or (iii) does not farm and is primarily engaged in nonagricultural activities

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