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Interlinked credit, relational contracting, and the spread of rural-based manufacturing: the case of garment and metalcraft industries in the Philippines

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Abstract

Subcontracting arrangements based on relational contracting between urban traders and rural-based manufacturers provide an important means for spreading manufacturing in rural areas. Within these arrangements, the payment of advances is a form of credit interlinking that addresses the isolation of rural-based enterprises from the formal finance sector. This viewpoint motivates specification of a testable hypothesis: advance payments are greater the more remote a rural-based subcontractor is from the urban center. The paper shows that such a hypothesis can be derived from a simple principal-agent model of the subcontracting relation. Moreover, the hypothesis is empirically confirmed by multivariate analysis of data from a case study of garment and metalcraft industries in the Philippines. The finding supports the view that subcontracting arrangements may be an organizational form appropriate to rural industrialization.

JEL classification: L24, O14, R51
Keywords: Interlinked contracts, rural industrialization

1. Introduction

Following the East Asian success with rural industrialization, inquiry about the conditions for rapid and sustained growth of rural-based manufacturing has spawned a good deal of research. Hayami [1998] stylizes a dynamic rural-based industry as one which produces for urban and even foreign markets, with marketing activities remaining headquartered in urban areas.

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This situation raises the critical issue of organizational form. At opposing ends of the spectrum of organizational forms are the vertically integrated firm and the spot market. Hayami [1998] has suggested that the subcontracting system, a form intermediate to the spot markets and vertical integration, is more appropriate for supporting urban-rural linkages. Such systems are interpreted as case of relational contracting, in which commercial transactions are long term, supported by personal ties, and intertwined with assistance from urban contractors in the form of technical advice and advances of cash or materials.

The provision of advances may be regarded as a form of credit interlinkage within a relational contract. Such advances appear to be an important factor in the spread of rural-based industry, given a financial sector that is geographically segmented, and rural-based enterprises that face high cost of and limited access to formal finance. Suppose that interlinked financial assistance within a relational contract performs a functional role of countering the disadvantages of geographic remoteness (such as weaker links to the formal finance, and higher transaction cost). Then one may hypothesize the following: advances become larger as a subcontractor's location becomes more geographically remote.

To confirm the hypothesis, this study undertakes two related tasks: first, the hypothesis is rendered coherent and plausible by framing it within a simple optimization model. Second, the hypothesis is tested using data from a survey of urban-rural subcontracting networks in Philippine manufacturing. The survey covers the garment and metalcraft industries, which have previously been investigated by Kikuchi [1998], and Hayami, Kikuchi, and Marciano [1997], respectively. This paper is extends these studies by its use of formal methods in explaining and testing the main hypothesis.

The rest of the paper is organized as follows: Section 2 presents the analytical framework for urban-rural subcontracting. Section 3 introduces the industries selected for the case study; Sections 4 and 5 discuss respectively the method and results of the empirical analysis. Section 6 concludes.

2. Analytical framework

This analytical framework discusses the rationale for regional specialization of trading and manufacturing activities, as well as the organizational forms that may characterize interregional linkages. The section concludes with a simple model of interlinked credit within a subcontracting relation.

2.1 The setting

The distinction between urban and rural areas arises from the dense concentration of economic activity in the former. The concentration of firms in urban areas is attributed to economies of scale, which are either external or internal.

An important example of external economies of scale would be those enjoyed by marketing activities: each marketing enterprise benefits from spatial proximity to others due to reduced search cost, as well as information spillovers. Meanwhile, internal economies of scale can still lead to agglomeration economies due to pecuniary externality (e.g., Krugman [1991]).

However, industries produced without significant scale economies (external or internal) benefit little from agglomeration. On the contrary, the oft-noted tendency for labor wages to decline with remoteness from the urban center leads to a movement of these industries out to the rural peripheries to take advantage of cheaper labor. Such urban-rural wage differentials meanwhile may be traced to the divergence between the urban and rural price of an immobile consumption good, i.e. housing [Hanson 1996].

As trading activities remain concentrated in urban areas, the problem of coordinating upstream manufacturing with downstream marketing arises. Such coordination can be undertaken through various types of supply arrangements, such as spot market purchases by urban traders, establishment of rural branches by urban manufacturer-traders, or subcontracting of rural producer by an urban trader. The actual coordinating arrangement would depend on the nature of the contracting problems confronting urban- and rural-based agents. These contracting problems are a consequence of market imperfections endemic to rural areas of developing countries, including asymmetric information and weak enforcement.

For some major industries, particularly those subject to intense product differentiation, information about demand is basically monopolized by traders [Ohno and Kikuchi 1998]. Given fluidity of demand, the problem of timely delivery of appropriately designed products restricts reliance on the spot market. Vertical integration can potentially address these design and timing requirements, but is however stymied by inadequate incentives towards asset maintenance [Holmstrom and Milgrom 1995]. These weak incentives are exacerbated by transaction costs due to the geographic remoteness of the rural-based manufacturer.

2.2 Subcontracting and relational contracting

Urban-rural subcontracting, which is intermediate to the spot market or the vertically integrated firm, may emerge as the most appropriate organizational form. The urban trader contracts with the rural manufacturer to deliver products of a specified design, at a specific time, for a specific payment. The transactions are, therefore, highly structured (in contrast to the usual spot market transaction) and the subcontractor owns the means of production (in contrast to the vertically integrated set-up).

The subcontracting system though remains fraught with organizational problems. First is the problem of enforcement: the urban-based contractor faces the possibility of late, insufficient, or substandard deliveries. The threat of contract

breach on the part of the subcontractor may be a strategic move to extract surplus [Hanson 1995]. Second is the problem of segmented markets: in particular, the rural-based subcontractor may be hobbled in its operations by costly or rationed credit.

The urban-based contractor may adopt various instruments in response to the foregoing problems. The enforcement problem may be dealt with by screening, monitoring, as well as the intertemporal structuring of incentives within an idiosyncratic, durable relationship. The segmented market problem may be dealt with by incorporating credit in the terms of payment. These features prompt the designation of the system as one of relational contracting.

If it is plausible that linkages with the formal credit market weaken as villages become increasingly remote, then the notion that relational contracting is an adaptation to market failure leads to the following testable hypothesis: subcontractors more distant from the main urban center will receive more advances (as a proportion of their output). Confirmation of the foregoing, which we refer to as the adaptation hypothesis, would buttress the idea that contractors increasingly provide important credit support as manufacturing activity spreads out across the countryside. Though conceivably such support is transitional [Ohno and Kikuchi 1998], such adaptations should still play a vital role during market evolution.

The adaptation hypothesis is, however, far from self-evident. In particular, increasing remoteness is associated with higher monitoring costs, which suggests ambiguity in the direction of the effect of remoteness on proportional advances. A greater precision in arguing for the adaptation hypothesis can be achieved by modeling it within a standard optimization framework based on the principal-agent theory. We find that a simple yet plausible subcontracting model unambiguously yields the adaptation hypothesis. The model focuses on the dimensions of monitoring and interlinked credit, broadly defined in terms of advances of cash or materials. Other features of the relational contract, while important, are for simplicity held fixed in the analysis.

2.3 The model

Consider a purchase order of the amount Q and price P, both fixed, and received by a contractor in period 1, for delivery in period 2. Her cost is described by a differentiable function, $C = C(Q)$, with positive first and second derivatives. Cost is financed by borrowing from the urban credit market, where one plus the interest rate is r. The contractor has the option of shifting in period 1 an amount q, $0 \leq q \leq Q$, to a subcontractor who resides in a rural area, for delivery in period 2. In this set-up the contractor is the principal, while the subcontractor is the agent.

The subcontractor also has a cost function $c(q;\beta)$ with the positive first and second derivatives in q; β meanwhile is a shift parameter, such that

$c_\beta > 0, c_{q\beta} > 0$, i.e. it shifts upward both the cost and marginal cost curves. Subcontractor cost is also financed by borrowing from the rural credit market, such that period 2 cost is $c(q)tr$, where $t \geq 1$. If $t > 1$, the credit market is segmented.

Payment of the subcontractor can occur in period 2, upon delivery, or in period 1, upon contracting. The advantage of advance payment under a segmented credit market is that unit capital cost of the advance is r, but the subcontractor saves a unit capital cost tr. Here only the cash value[1] of the advance is relevant; it is stated as a proportion of cost and is denoted λ, with $0 \leq \lambda \leq 1$.

Suppose the contractor can select output, the amount advanced, and the delivery payment. The subcontractor can only choose to accept or reject the entire contract. Then the contractor extracts the entire surplus from subcontracting; payment equals $c(q)$ and associated interest costs. Note that this is a departure from the usual principal-agent set-up in which the agent is in general free to choose the level of effort, compelling the principal to observe an incentive constraint. Here the principal only observes a participation constraint, normalized to zero.

The contractor's problem, therefore, reduces to a choice of q and λ. As noted above, payment of advances has the advantage of arbitraging the interest rate differentials between urban and rural areas. On the other hand, paying advances leaves the contractor vulnerable to intentional reneging. By reneging, the subcontractor gets to keep the advance, but period 2 payment is thereby forfeited. Hence, if the subcontractor is to renege at all, then such an option will have to be taken prior to production, i.e. before any working capital becomes an *ex post* sunk cost.[2]

Contract compliance is associated with a probability δ, a subjective estimate made by the contractor. The probability of reneging is, therefore, $1-\delta$. Furthermore, the contractor associates each possible λ with a different δ. Suppose the resulting function, which is exogenous to this model, is differentiable. It is reasonable to impose $\delta_\lambda < 0$, i.e. higher proportional advances raise the estimated likelihood of reneging. Furthermore, the reduction in δ is more rapid for greater values of λ, i.e. $\delta_{\lambda\lambda} < 0$.

Once a subcontractor starts to produce, deviation from the contract may still be possible if costs are overstated. One may conceive of *ex post* cost reporting that permits the agent to shirk from the commitment to completely supply q. By assumption, the principal eliminates asymmetric information on costs by monitoring the subcontractor's production. However, monitoring also comes at a cost M, where $M = M(q;\theta)$. M possesses the same properties as c, i.e. positive first and second derivatives in q, $M(0) = 0$, and θ a positive shift parameter for both monitoring and marginal monitoring costs. Notice that the payment of advances does not

[1] Admittedly, in-kind advances serves a purpose, e.g. putting out of materials may help maintain output quality. This is not directly relevant to our purpose, however.

[2] It is assumed that any produced q has a zero value unless sold to the contractor.

enter the monitoring cost function. As seen above, once reneging takes place there is no subcontracted production to monitor. Furthermore, the parameter θ represents factors that can raise monitoring cost, such as the geographic remoteness of the subcontractor.

Putting all these together (and suppressing the shift parameters), the contractor's expected profit is stated as:

$$\Pi = P(Q-q) - C(Q-q)r + \delta(\lambda)[Pq - M(q) - c(q)tr(1-\lambda)] - \lambda c(q)r. \qquad (1)$$

This completes the basic set-up of the model. Equilibrium and comparative statics can now be characterized.

2.4 The optimal solution and comparative statics

Equilibrium is found by maximizing P by choice of q and l. For an interior solution, the first order conditions are:

$$\Pi_q = -P + C'(Q-q^*)r + \delta(P - M_q(q^*) - c_q r[\delta(1-\lambda^*)t + \lambda^*] = 0, \qquad (2)$$

$$\Pi_\lambda = \delta_\lambda[Pq^* - M(q^*) - c(q^*)tr(1-\lambda^*)] + c(q^*)r(\delta t - 1) = 0. \qquad (3)$$

The asterisk denotes a solution value for the choice variable. Note that if $t = 1$ then positive advances imply $\Pi_\lambda < 0$, hence advances are set at zero. An interior solution is therefore possible for λ only if $t > 1$, although this is not a sufficient condition. That is, advances are extended only because of segmentation of the credit market. This is consistent with the credit function of advance payments.

Denoting the Hessian of Π as $|H|$, the second order condition for a maximum is $|H| > 0$, which is henceforth imposed. In our model we have the shift parameters β, θ, and t; representing a shift parameter as α the choice variables may be written as implicit functions $q^*(\alpha)$, $\lambda^*(\alpha)$. Implicit differentiation yields:

$$\frac{d\lambda}{d\alpha} = \frac{-\Pi_{qq}\Pi_{\lambda\alpha} + \Pi_{\lambda q}\Pi_{q\alpha}}{|H|},$$

$$\frac{dq}{d\alpha} = \frac{-\Pi_{q\alpha}\Pi_{\lambda\lambda} + \Pi_{\lambda\alpha}\Pi_{q\lambda}}{|H|}.$$

Clearly $\Pi_{qq} < 0$, $\Pi_{\lambda\lambda} < 0$; however is not easily signed. To determine its sign, consider the impact of a change in the subcontractor's cost structure: letting $\alpha = \beta$, then

$$\Pi_{q\beta} = -c_{q\beta} r[\delta(1-\lambda^*)t + \lambda^*] < 0,$$

$$\Pi_{\lambda\beta} = -\delta_\lambda c_{q\beta} tr(1-\lambda^*) + c_\beta r(\delta t - 1] > 0.$$

It is reasonable to expect $dq^*/d\beta < 0$: when subcontracting is more costly, then the amount subcontracted should fall. To ensure this result, $\Pi_{\lambda q} \leq 0$ is imposed.

Next, consider the impact of an increase in the interest rate differential. Letting $\alpha = t$, then

$$\Pi_{qt} = -c_q r\delta(1-\lambda^*) < 0,$$

$$\Pi_{\lambda t} = -cr\delta_\lambda(1-\lambda^*) + cr\delta > 0.$$

Accordingly, hence the greater the interest rate differential, the greater the proportional advances. This reinforces the interpretation that advances are an institutional adaptation to market failure.

Furthermore, differences in t provide a way to incorporate the factor of location in determining the advance payment. If the local interest rate is larger for more geographically remote locations, then *ceteris paribus* advance payments would be larger for these locations. However, it is only realistic to allow monitoring cost to rise with increasing remoteness; hence, if advances are adversely affected by monitoring cost, then the impact of remoteness on advances may turn out to be ambiguous.

It is a simple matter to check whether or not higher monitoring cost would indeed reduce advances. Letting $\alpha = \theta$, then

$$\Pi_{q\theta} = -\delta M_{q\theta} < 0,$$

$$\Pi_{\lambda\theta} = -\delta' M_\theta > 0.$$

Therefore $d\lambda^*/d\theta > 0$. That is, higher monitoring cost is associated with greater advance payments. The reason is that the expected loss from default is lower for the remote subcontractors, precisely because orders are smaller; hence the contractor is less discouraged to pay advances. With this the issue is resolved unambiguously: advances are greater for locations more remote from the urban center, consistent with the adaptation hypothesis.

Having completed the analytical framework, the rest of the paper is devoted to empirical analysis, with the focus on testing the foregoing hypothesis relating remoteness to the magnitude of advance payments.

3. The metalcraft and garment industries in the Philippines

In this paper we focus on garments sewing as well as the manual fabrication of metallic novelty items in the Philippines. The final products in both industries are highly differentiated, with each specific design characterized by a short product cycle. This subjects producers to instability arising from both seasonal and uncertain demand fluctuations, rendering the development and use of mechanized mass production impractical. Rather, these industries are characterized by labor-intensive upstream production located in low wage areas. In the Philippines, exporters are usually based in cities (primarily Metro Manila and its environs) but much of the production is subcontracted out to rural-based factories and workshops.

3.1 Background of the selected industries

According to the country's trade and industry department, garment exporting in the Philippines began in the 1950s, when American buyers subcontracted backyard dressmakers and tailoring shops to produce for the US market. Within a ten-year period (1986-1996), the garments industry managed to double its share in the country's total exports. Currently, it remains the second top exporter. In 1996, 69 percent of exporters were located in Metro Manila. While numerous subcontractors are located in Metro Manila, their number has been decreasing, while subcontractors in the provinces have burgeoned. From 1993 to 1997, the share of subcontractors located just south of Metro Manila increased from 30 percent to 39 percent.

In the case of metalcraft, the shift from chiefly artisan work for the local market to products for the world market occurred in the late 1980s. Exporters soon began to outsource fabrication to rural-based subcontractors. Hayami, Kikuchi, and Marciano [1998] document within their survey village the rise of the manufacturing share in household income from only 1 percent to as much as 13 percent in just eight years.

For the common type of metalcraft, referred to as "tin and wire"(but actually using galvanized iron), only the simplest implements are used: a few soldering irons, metal scissors, pliers, and tables are sufficient to begin production. Fabrication is often housed in a makeshift shed without walls or flooring. Tin and wire craft uses only light materials available in hardware stores of any rural town, while other products may use more specialized materials.

In both industries, conformity with design is critical. Moreover, shipping schedules and costs impose stringent delivery deadlines. Exporters are in turn strict with product quality and delivery deadlines of their subcontractors. Inspectors are usually dispatched to their rural suppliers in the course of production.

3.2 The survey frame

The survey of metalcraft and garment subcontractors was conducted from June 1996 to September 1997. The questions covered the twelve months prior to interview. Respondents answered on the basis of recall. One hundred twenty subcontractors (59 metalcraft and 61 garment) are retained in the data set.

For garments, a directory of registered garment export subcontractors was used to generate a random selection of enterprises from Batangas and Laguna, two provinces south of the capital known for hosting a large number of subcontractors. We found, as did Kikuchi [1998], that the registry included numerous enterprises that had since shut down. To supplement our search, randomly encountered subcontractors were added to our sample.

In the case of metalcraft, no formal directory exists. Hence a search for these enterprises was made through referrals from exporters and other subcontractors. The metalcraft subcontractors were found in provinces surrounding Metro Manila (i.e. Laguna, Rizal, and Cavite.)

In both industries, search was roughly oriented towards a geographically dispersed pattern of respondents. The provinces covered by the survey contain burgeoning industrial sectors because of the outward spread of factories from the metropolis. The areas more distant from the metropolis, however, tend to be poorer, primarily agricultural, and less developed. In all these provinces roads permit convenient access to all the towns, although an occasional village (most likely to be found in the poorer half of a province) may be difficult to reach due to bad roads.

3.3 The sample enterprises

A profile of the sample enterprises is shown in Table 1. Both garments and metalcraft are small-scale, labor-intensive activities. The rate of return (ROR) calculation (last row) is the ratio of annualized surplus to the capital stock. Surplus is value-added net of labor and other costs, but gross of rent and interest payment. Capital stock includes equipment, facilities, and a one month cash reserve for materials, utilities, and labor. These definitions hew closely with those of Hayami, Kikuchi, and Marciano [1998]; the sample ROR for metalcraft is nearly identical to their estimate. While the large ROR figures need to be adjusted for risk, they remain indicative of the potential for further investment in and expansion of these industries.

Location is measured continuously by distance of the subcontractor's town from the main urban center, which is Metro Manila and its environs. Official distance estimates are based on the road distance from a specific point in Metro Manila to the subcontractor's locality. As the official definition of urban center is too restricted, we calculate a modified distance variable, which is distance from

Greater Manila. The Greater Manila area includes the urbanized towns outside the political boundaries of the metropolis (i.e. Biñan and Taytay).

Table 1. Characteristics of the Sample Enterprises

Characteristics	*Averages across firms*	
	Garments	*Metalcraft*
Output (total sales, '000 Php)	248.7	47.7
Value added ('000 Php)	158. 5	32.6
Capital stock ('000 Php)	1,113.20	271.3
Number of workers	31	16
Labor share in value added (%)	62	58
Rate of return (%)	53	148

NOTE: The garment output and value-added calculations count only the payment for sewing services.

The analysis also incorporates discrete indicators of location. For garments, a distinction is made between village and non-village locations. For metalcraft, a distinction is drawn between rural and non-rural locations, where the latter is defined with respect to the urban center.[3]

Advance is defined as the cash value of transfers from the contractor to the supplier prior to delivery, as a proportion of output. Here a "contractor" is a customer who has placed an order over the twelve months prior to interview. Calculation of advances includes materials with an imputed a cash value. Often it is possible to calculate the cash value based on the explicit putting out deduction of the contractor (though this value typically exceeds the monetary value of the materials based on market prices.)

For garment enterprises, the computation of advances is rather involved. The price of the subcontractor's services omits the value of the put out fabric. Hence, calculation of advances excludes this material cost. The remaining elements of advances are pre-delivery cash payments, advances of thread, and the imputed rent of equipment borrowed from the contractor. For the imputed rental of equipment, we apply a rate of return of 40 percent to the value of the machines.[4] The final adjustment introduces information regarding payment delays for garment enterprises. Payment given at the end of the year (the so called "retention") is subtracted from the advance; this delay is regarded as sufficiently great so as to offset whatever benefits were obtained from early payment. As the contracted price already omits the implicit rental cost, this amount is added to output in order to calculate the advance.

[3] The rural zones comprise all areas beyond the transition towns, where a transition town is the agrarian-based town nearest Metro Manila. The rural zone begins, in the east, 29.3 km. from Manila; and the southeast, 62 km. No rural enterprises were found in the other cardinal directions.

[4] The second hand market value the most commonly rented machine (the high-speed single needle) is around 8,000 pesos, while the market rental rate is 300 pesos.

Advance payment across locations may now be compared (Table 2). There being only few garment enterprises in the village category, we adopt a demarcation between "near" and "far" enterprises at the median distance. For metalcraft, the striking difference between rural and non-rural enterprises is the magnitude of advances. Consistent with our hypothesis, the nearer enterprises obtain much less credit in relative and absolute terms. For garments, the difference between the advances received by the near and far enterprises is minimal. Contrary to our hypothesis, the nearer enterprises receive more advances. Such tabulations are not reliable however, as several other factors are varying along with distance and advance. In the following section we undertake regression analysis to control for these other variables and isolate the effect of location.

Table 2. Characteristics of Sample Enterprises by Industry and Location

	Garments		*Metalcraft*	
	Near	*Far*	*Non-rural*	*Rural*
% sample enterprises	50.0	50.0	37.0	63.0
Number of contractors	2.1	2.2	2.7	2.1
Distance from Manila (km)	67.6	100.0	36.3	72.4
Advances (%)	23.1	20.0	19.0	31.2

4. Regression model

The dependent variable in our model is proportional advances, defined as the ratio of advances to output. The independent variables are indicators of location, tendency to renege, production cost, capital cost, and product type. Indicators of trustworthiness of the subcontractor are relationship indicators, such as pre-existing tie, as well as duration of subcontracting relation. Number of contractors may also be a correlate of inability or unwillingness to comply with any particular contractor's purchase order.

Years of experience in the business, age, and years of schooling may denote enterprise-specific and general human capital, which may imply lower cost of obtaining credit, as well as greater productivity. We predict based on Section 2 that greater productivity and lower capital cost imply smaller advances, hence these indicators are expected to have negative coefficients.

Finally, the enterprise's capital stock is an indicator of capital access. We remove the value of current net investments and use the previous year's capital stock. We expect a positive coefficient from the capital effect. Note, however, that a large component of capital stock is immobile investments, such as buildings, which may suggest to the contractor a low likelihood of absconding. Hence the total effect of capital stock on proportional advances is ambiguous.

The continuous independent variables are expressed in logarithms. Hence we adopt a semilog specification. The location variables are: distance from Greater Manila (DIST), village dummy (non-village omitted) (VILL), distance from Greater Manila of rural enterprise located east (RDISTE), distance from Greater Manila of rural enterprise located southeast (RDISTS).

Our main concern is location. To confirm our hypothesis, we expect positive and significant coefficients for the location variables. The location variables are proxying for increasing severity of monitoring problems and poorer credit access in more remote areas. The variable VILL is specific to the garment sample, while RDISTE and RDISTS are specific to the metalcraft sample. We distinguish the rural east from rural southeast as the variation of transaction cost with respect to distance may differ with the cardinal direction. There are no rural subcontractors in the other cardinal directions.

For garments enterprises, we apply the combination DIST and VILL. Meanwhile two sets of location indicators are possible for metalcraft. The first consists of DIST, RDISTE, and RDISTS, the second only RDISTE and RDISTS. The former is equivalent to the "slope dummy" set-up (had we included a rural dummy variable). The latter implies that the urban "center" is the entire non-rural area, including the urbanizing outskirts of the dense metropolitan area.

The natural observation unit is the enterprise itself. However, as one subcontractor may be related to several contractors, contractor-specific variables take a weighted average value for a subcontractor, where the weights are the proportion of that contractor's orders in annual output. In the following, the reference to "omitted" in the case of a dummy variable is the state in which the dummy takes on a zero value. The other independent variables in the regression model are: years of relationship with contractors (weighted average) (YRKNOW), relationship dummy[5] (REL), total years of schooling of the subcontractor (SCHOOL), age of the subcontractor (AGE), number of contractors (NBUY), last year's capital stock (CAP). As stated earlier, the variables are all in logarithms, except for NBUY, which takes an integer value. Meanwhile the product types for metalcraft and garment are, respectively: specialized metalcraft (tin and wire metalcraft omitted) (SPMET), manufacturer of adult garment wear (children's wear omitted) (ADULT). The dependent variable is denoted ADV. The most obvious procedure is to apply ordinary least squares (OLS) on enterprise observations separately for garment and metalcraft data. Alternative regressions are conducted in case violations of classical assumptions are discovered.

Finally, given that many subcontractors have multiple contractors, the model is respecified in terms of contractor observations. This involves redefining ADV, YRKNOW, and REL to be specific to each contractor accepted by the sample subcontractor. Other subcontractor-specific independent variables (age, years of schooling, etc.) are retained, but are common to the multiple observations obtained from a subcontractor.

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[5] omitted are subcontractors unrelated to any contractor by kinship or previous employment

5. Results

In this section the results of the regressions using the foregoing model are presented. First, we discuss the specification using enterprise observations, followed by the specification using contractor observations.

5.1 Enterprise observations

The results of the garment enterprise least squares regressions are presented in Table 3. In column 1 the coefficients for the location variable DISTGM and VILL are positive, contrary to the pattern suggested in Table 2 and consistent with the adaptation hypothesis. The distance variable has a statistically significant effect on advances. The Ramsey reset test (with powers of the independent variables on the right hand side) fails to establish the presence of an omitted variable. The Cook-Weisberg test, however, reveals the presence of heteroskedasticity. In the absence of a priori information regarding its structure, we implement the "robust" regression, results of which are reported in column 2. The White corrected standard errors continue to reject a zero value for the location coefficients.

The other coefficients are of expected sign in either regression, except for that of CAP. Of these variables, the significant coefficients are those of REL and SCHOOL. The positive sign of the REL coefficient is consistent with the emphasis of the relational contracting framework on the importance of personal ties. The YRKNOW coefficient, however, while positive, is insignificant, suggesting that duration of relationship need not always correlate with the strength of the tie. Meanwhile, the SCHOOL coefficient is negative and significant, consistent with expectation.

The CAP coefficient, for which we have no definite sign expectation, has a positive sign and a high t-value (3.23). The immobility of garment capital perhaps raises the perceived probability of compliance, thus allowing more advances to be given. This apparently offsets the tendency for advances to fall with improved capital access. A check of the correlation matrix shows a high and significant correlation coefficient (0.27) between CAP and DIST. This may partly explain the pattern in Table 2, where the "Near" enterprises, which tend to have large stocks of immobile capital, receive more proportional advances.

The regressions for the sample metalcraft enterprises are shown in Table 4. The first column uses DIST, RDISTE, and RDISTS, while the second drops DIST. Whereas the rural distance variables are significant in both regressions, DIST is insignificant when it is included. Moreover, its exclusion raises the adjusted R^2. Hence DIST appears to be an extraneous variable that may be safely discarded.

Table 3. Regression Results For Garment Enterprises

Variables	*Coefficient values*			
	1	Standard Errors	2	Standard Errors
DIST	0.182**	(0.061)	**	(0.058)
VILL	0.075	(0.07)	***	(0.065)
ADULT	0.060	(0.052)		(0.057)
REL	0.146**	(0.063)	**	(0.067)
YRKNOW	0.021	(0.023)		(0.020)
NBUY	-0.020	(0.018)		(0.015)
SCHOOL	-0.168***	(0.062)	***	(0.049)
AGE	0.168*	(0.099)	*	(0.091)
YRBUS	-0.051	(0.032)	*	(0.033)
CAP	0.074***	(0.023)	***	(0.023)
Constant	-1.612**	(0. 635)	**	(0.602)
$P(F > F_c)$	0.00		0.00	
R^2	0.52		0.52	
Adj R^2	0.42		-	

NOTES: Significance at the 10%, 5%, and 1% levels are represented by one, two, and three stars, respectively. Ramsey reset test on column 1 regression yields $P(F > F_c) = 0.59$ for the null hypothesis "no omitted variable". The Cook-Weisberg test meanwhile yields $P(\chi^2 > \chi_c^2) = 0.01$ for the null hypothesis "constant variance of error terms".

The reset test for the column 2 specification fails to reject the absence of an omitted variable. However, heteroskedasticity is present, as in the garment OLS regression. Correction likewise involves the robust regression, whose results are shown in column 3. The pattern of significance among the coefficients has not changed, except for the addition of NBUY as having a significant coefficient in the robust regression. Note that the standard errors of the RDISTS coefficient have fallen sufficiently as to make it significant at the 5 percent level.

The coefficient signs in the metalcraft regression are identical with their counterparts in the garment regression, with the exception of the YRBUS and CAP coefficients. The positive sign of the latter coefficient suggests that the capital cost effect overwhelms the deterrent effect. One noteworthy difference between garment and metalcraft enterprises is the much smaller capital stock of the latter, particularly for immobile fixtures such as buildings. The reason for a positive effect, noted earlier, does not work here, as larger metalcraft firms may not have permanent structures, such that they may be viewed as almost equally prone to reneging as the smaller firms.

Table 4. Regression Results For Metalcraft Enterprises

Independent variables	1	Standard Errors	2	Standard Errors	3	Standard Errors
DIST	-0.003	(0.028)	-		-	
RDISTE	0.083***	(0.025)	0.081***	(0.024)	***	(0.027)
RDISTS	0.026	(0.020)	0.024*	(0.014)	*	(0.012)
SPMET	0.058*	(0.061)	0.059	(0.060)		(0.064)
REL	0.195**	(0.082)	0.195**	(0.081)	*	(0.100)
YRKNOW	0.009	(0.060)	0.009	(0.059)		(0.070)
NBUY	-0.023	(0.016)	-0.022	(0.016)	*	(0.013)
SCHOOL	-0.126*	(0.071)	-0.126*	(0.070)	*	(0.065)
AGE	0.101	(0.130)	0.102	(0.128)		(0.131)
YRBUS	0.070	(0.044)	0.070	(0.043)		(0.040)
CAP	-0.242*	(0.012)	-0.024*	(0.012)	*	(0.013)
Constant	0.251	(0.539)	0.238	(0.522)		(0.515)
$P(F > F_c)$	0.01		0.00		0.00	
R^2	0.37		0.37			
Adj R^2	0.22		0.24		-	

NOTE: For column 2, Ramsey reset test yields $P(F > F_c) = 0.46$ for the null hypothesis "no omitted variable." The Cook-Weisberg test meanwhile yields $P(\chi^2 > \chi_c^2) = 0.01$ for the null "constant variance of error term".

5.2 Contractor observations

So far we have confirmed our hypothesis regarding the relationship between proportional advances and distance. We now rerun the appropriate specifications for the garment and metalcraft regressions using contractor relationships as distinct observations. The results are reported in Tables 5 and 6. Column 1 of these tables presents the results of the the robust regression, while column 2 shows the results of the random effects regression. The robust regression is implemented due to the presence of heteroskedasticity discovered in the enterprise regressions.[7] Meanwhile, the contractor observations are naturally grouped by firm, suggesting the presence of a firm-specific error term. The Hausman test is used to check whether the random effects set-up is appropriate. The results for the garment sample shown in Table 5 are broadly similar to those of the enterprise observations. Coefficients have the same sign, though magnitudes differ.

[7] In a separate regression (not shown) we use OLS and test for the presence of heteroskedasticity; we find that the constant variance hypothesis is rejected at the 1% level of significance for both industries.

Table 5. Regression Results For Garment Contractors

Variables	*Coefficient values*			
	1	Standard Errors	2	Standard Errors
DIST	0.216**	(0.052)	0.216**	(0.055)
VILL	0.068	(0.053)	0.068	(0.064)
ADULT	0.057	(0.039)	0.057	(0.046)
REL	0.146**	(0.077)	0.145**	(0.071)
YRKNOW	0.027	(0.026)	0.027	(0.027)
NBUY	-0.017	(0.014)	-0.017	(0.015)
SCHOOL	-0.186***	(0.055)	-0.186***	(0.057)
AGE	0.138*	(0.075)	0.138*	(0.077)
YRBUS	-0.060*	(0.032)	-0.060**	(0.028)
CAP	0.077***	(0.027)	0.077***	(0.028)
Constant	-1.64**	(0. 649)	-1.64***	(0.533)
R2	0.35		0.35	

NOTES: The Hausmann test yields for the null hypothesis "no correlation between variables and error terms".

Table 6. Regression Results for Metalcraft Contractors

Variables	*Coefficient values*			
	1	Standard Errors	2	Standard Errors
RDISTE	0.032*	0.017)	0.057***	(0.021)
RDISTS	0.021**	(0.008)	0.026**	(0.012)
SPMET	0.031	(0.042)	0.059	(0.052)
REL	0.191**	(0.098)	0.212***	(0.067)
YRKNOW	0.017*	(0.031)	0.002	(0.026)
NBUY	-0.022**	(0.010)	-0.032**	(0.031)
SCHOOL	-0.131***	(0.048)	-0.135**	(0.064)
AGE	0.072*	(0.081)	0.074	(0.105)
YRBUS	0.036	(0.024)	0.062*	(0.035)
CAP	-0.016***	(0.009)	-0.021**	(0.010)
Constant	0.316	(0.301)	0.362	(0.434)
R^2	0.35		0.35	

NOTES: The Hausmann test yields for the null hypothesis "no correlation between variables and error terms".

The standard errors are also close. Relative to the coefficient value, the standard error of the DIST coefficient has noticeably decreased. Between columns 1 and 2, however, we find that the coefficients generally pass more stringent significance tests in the latter. In particular, REL is now significant at the 5 percent level. The Hausman test fails to reject the random effects specification. In view of a possible firm-specific error term, we take the random effects regression to be the more reliable one.

For metalcraft contractors (Table 6), the pattern of the results are again generally consistent with those of the enterprise regressions. What is striking is the dramatic improvement of the standard errors, resulting in high t-values for some of the coefficients in the random effects regression. Once more the Hausman test does not reject this specification. Compared to the enterprise regression, the distance coefficients are significant under stricter standards. Recastin the data set in terms of contractor observations does not significantly alter the previous results based on enterprise observations.

6. Conclusion

This paper examines the adaptability of the subcontracting system as an organizational form coordinating urban-based marketing with rural-based manufacturing. Such a system seems to embody a flexibility that is absent in either the spot market or within a vertically integrated firm, hence appears capable of addressing a wide range of market failures endemic to rural areas.

The focus of the study is the provision of credit in the form of advance payments within a subcontracting relation. Consistent with the foregoing perspective, the study states the adaptation hypothesis: subcontractors located in areas more remote from the urban center will receive more advances from their contractors. That is, the subcontracting arrangement adjusts, at least in part, to the disadvantages associated with remoteness.

The adaptation hypothesis is inferred from a simple principal-agent model of the subcontracting relation. Meanwhile empirical analysis, based on a case study of the garment and metalcraft industries in the Philippines, confirms the hypothesis. The analysis adequately controls for other variables affecting the payment of advances.

The application of the foregoing analysis to other industries and settings, possibly with alternative specifications of location, would be an interesting topic for further study. Moreover, as we have looked at only interlinked credit, further empirical work needs to be done on the other aspects of a subcontracting arrangement. The nexus of issues pertaining to organization and location, as illustrated in this paper, suggests a promising research program for the study of rural industrialization.

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