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Douglas W. Allen; Dean Lueck

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Risk Preferences and the Economics of Contracts

By DOUGLAS W. ALLEN AND DEAN LUECK*

> "[T]he literature of risk aversion and risk preference [is] one of the richest sources of *ad hoc* assumptions concerning tastes. ... [N]o significant behavior has been illuminated by assumptions of differences in tastes. ... [Such theories] have been a convenient crutch to lean on when the analysis has bogged down. ... They give the appearance of considered judgement, yet really have only been *ad hoc* arguments that disguise analytical failures." —George J. Stigler and Gary S. Becker (1977 p. 89)

Assumptions of risk aversion in modern economics are pervasive, and economists who substitute risk neutrality often do so with an apology. This is particularly true for contract theories, like the principal–agent model. Despite the theoretical prominence of risk aversion, empirical contract studies tend to ignore risk preferences and focus exclusively on transaction costs, thus stressing specific incentives, enforcement costs, and transaction-specific assets. Accumulated evidence confronting risk-sharing and transaction costs—covering such topics as franchising, gold mining, sharecropping, and timber—actually favors the transaction-cost framework. This paper examines risk preferences in contract theory and the evidence failing to support theories relying on risk-averse agents.

I. Contract Theory and Risk Preferences

Modern contract theory began with Steven N. S. Cheung's (1969) study of sharecropping in China. Shortly thereafter, Joseph E. Stiglitz (1974) initiated a formal principal–agent theory which remains largely intact (Paul Milgrom and John Roberts, 1992). To this day, contract theory often focuses on the share contract, which is present throughout the economy in agriculture and beyond, from business partnerships to franchise contracts to royalty-based leases.

A. *Share Contracts in the Traditional Principal – Agent Framework*

The standard sharecropping model illustrates the principal–agent framework and begins with several routine assumptions. First, the landowner (principal) is risk-neutral, while the farmer (agent) is risk-averse. Second, crop output depends on both the farmer's effort and on random forces (e.g., pests and weather). Finally, the farmer's effort is the only margin for moral-hazard behavior; the landowner cannot shirk, and his land cannot be exploited by the farmer. This model creates a trade-off between risk-avoidance and improper incentives, generating well-known predictions about the structure of share contracts and the choice between share and fixed-payment contracts (Cheung, 1969; Milgrom and Roberts, 1992; Keijiro Otsuka et al., 1992). In sum, "Efficient contracts balance the costs of risk bearing against the incentive gains that result" (Milgrom and Roberts, 1992 p. 207). From the assumed structure of risk preferences, two important predictions emerge. First, as the random variability of output increases, share contracts are more likely to be chosen. Second, share contracts will not be chosen unless farmers are risk-averse.

B. *Shortcomings of the Risk-Sharing Paradigm*

Despite the intuitive appeal of the risk–incentive trade-off, there are problems

*Allen: Department of Economics, Simon Fraser University, Burnaby, BC, Canada V5A 1S6; Lueck: Yale Law School, New Haven, CT 06520, and Department of Economics, Louisana State University, Baton Rouge, LA 70803. Jonathan Conning provided helpful comments on an earlier draft.

with the paradigm that likely explain its empirical failings. We note the general problems and include examples from farming to provide an empirical context.

First, principal–agent models routinely assume an ad hoc dichotomy in the preferences of principals and agents. It is routinely assumed that landowners are risk-neutral and farmers are risk-averse. This dichotomy is crucial in generating predictions for real contract choices. In farmland leasing where the choice is between crop-sharing and cash renting (hired farmers are not an option) the farmer must be more risk-averse to generate a prediction favoring crop-sharing. If the landowner were more risk averse, then the model would predict cash-rent contracts. The risk-preference dichotomy is especially strained for North American agriculture, where farmers and landowners have remarkably similar demographic characteristics (Allen and Lueck, 1992, 1995).

Second, predictions from risk-sharing models are difficult, if not impossible to test with existing data. Since individual risk preferences are not measurable, the predictions using preference parameters are *never* testable. Even predictions involving the variance in the random input are difficult to test because the observable output variance is determined by both the exogenous random input and by choices made by contracting parties. Often it is not possible to purge the endogenous variability from data in order to measure the exogenous component of variability which is a parameter in the principal–agent model (Francine Lafontaine, 1992; Allen and Lueck, 1995). Modern agriculture is a uniquely good place to test the theory, however, because there are good contract data to go with data on crop-yield variability for reasonably homogeneous regions inhabited by many small farmers.

Third, the risk–incentive trade-off is generated by a model which assumes just one margin for shirking (agent's effort). The one-sided model, however, severely constrains the analysis of contracts. To begin, the principal may choose effort (e.g., landowners often control irrigation and fences) and thus also be a source of moral hazard. Also, the single-margin model ignores the often significant costs of measuring and dividing the shared output (e.g., farmers can underreport yield or cheat on quality). In addition, actual contracts are incomplete so the assets can be damaged (farmers can abuse land) by the effort choices of the other party.

Finally, because risk avoidance and agent effort are generic, one-dimensional parameters, not varying across products, the model suggests that it is appropriate to lump together contracts for widely diverging goods. In effect, the model "authorizes" estimation of crop-sharing using data from a wide variety of crops, or of franchising using data from such diverse products as dry cleaning and fast food. With double moral hazard, incomplete contracts, and measurement costs, the incentives are expected to be product-specific. Hence, highly aggregated tests of the risk–incentive trade-off are misleading.

C. *Transaction Costs: A Risk-Neutral Alternative*

The transaction-cost framework avoids the difficulties of relying on risk preferences by focusing on the costs of enforcing contracts and the incentives inherent in those contracts. Contracting parties are assumed to be risk-neutral, each controlling different inputs and influencing output. As in the principal–agent framework, random forces affect production, so that output and inputs are costly to observe and, thus, subject to theft. This paradigm has several basic insights. First, the risk preferences of the contracting parties have no influence on contract choice or structure. Second, share contracts distribute the deadweight losses from moral hazard over many margins (Mukesh Eswaran and Ashok Kotwal, 1985; Allen and Lueck, 1992, 1995; Lafontaine 1992). Third, share contracts create incentives for theft for those assets (inputs or output) that are shared. As a result, share contracts are chosen when the costs of dividing and measuring shared assets are

TABLE 1—EMPIRICAL STUDIES USING CONTRACT-LEVEL DATA

Authors	Topic	Support for risk-sharing	Support for transaction costs
Allen and Lueck (1992)	farmland	no	yes
Allen and Lueck (1995)	farmland	no	yes
Hallagan (1978)	gold mining	no	yes
Mulherin (1986)	natural gas	no	yes
Leffler and Rucker (1991)	timber sales	no	yes

TABLE 2—CROP RISKINESS AND PREVALENCE OF SHARE CONTRACTING

	Yield coefficient of variation (percentage share contracts)	
Region [date of sample]	Corn	Wheat
British Columbia [1992]	0.27 (20)	0.18 (79)
Louisiana [1992]	0.29 (62)	0.21 (76)
Nebraska [1987]	0.12 (69)	0.11 (86)
South Dakota [1987]	0.14 (64)	0.25 (61)

Sources: Allen and Lueck (1992, 1995).

low and the margins for moral hazard are large and many.

II. Evidence from Empirical Contract Studies

Few studies have tested both risk and transaction-cost models. Table 1 shows those that used contract-level data. We provide a brief summary, considering agricultural separately because the risk-sharing model has been so dominant there (Otsuka et al., 1992).

A. *Evidence from Agriculture*

Although Cheung (1969) claimed to have evidence for the risk-sharing theory, his data were highly aggregated, he compared different crops, and he arguably did not use data appropriate for a clear test. Indeed, C. H. Hanumatha Rao (1971) promptly refuted Cheung when he found that Indian crops with high (low) yield and profit variance tended to be cash-rented (crop-shared). Yet even Rao's study is limited by the fact that his data were aggregated, though much less than Cheung's data.

A more recent study (Allen and Lueck, 1992) found that natural riskiness could not explain modern crop-share contracts for Midwestern corn and wheat. For farmland contracts, a risky setting can be identified by classifying crops according to their yield variability, using the coefficient of variation (CV) for a relatively homogeneous geographic region. A greater CV indicates a more risky crop which is more likely to be governed by a share contract rather than a cash lease. Using data from over 1,000 contracts, Table 2 shows the coefficient of variation for two major crops (corn and wheat) in four distinct regions and also shows, the prevalence of share-contracting for farmland in those same regions. Contrary to the risk-avoidance thesis, land used to grow high-variance crops is not share-leased more often. Evidence in Table 2 actually suggests the opposite: lower-variance crops are more often sharecropped. In a precise test (Allen and Lueck, 1995), we selected samples of land contracts with identical crops and estimated the effect of natural crop variability on contract choice. Contrary to the risk-sharing theory, our estimates failed to find a positive relationship between exogenous crop variability and the probability of sharecropping for 13 different crops from such varied locations as British Columbia, Louisiana, Nebraska, and South Dakota.

In Allen and Lueck (1992), we also found that crop-measurement costs and soil-exploitation problems explained the choice between cash-rent and crop-share contracts in the Midwest. Similarly, in Allen and Lueck (1993) we found that transaction costs, especially measurement costs, explained the design of share contracts, including the use of input-sharing. For a wide range of croplands, in Allen and Lueck

(1995) we also found that increases in crop risk (higher CV's) actually decreased the probability of crop-sharing, suggesting that measurement costs explain contract choice, since greater exogenous risk makes crop measurement more difficult and cash-rent contracts more likely. In Allen and Lueck (1995) we also examined contracts for other farm assets besides land, finding that sole ownership is the dominant regime for buildings and equipment, but not for land. Leasing of building and equipment, which is *never* based on output shares, is far less common than leasing of land. The paucity of equipment-sharing is consistent with the transaction-cost framework and inconsistent with risk-sharing. First, equipment use is notoriously difficult to monitor, and sharing dramatically reduces the incentive for optimal maintenance. Second, "output" from most farm equipment is difficult to measure (unlike the crop output from land) rendering fixed-payment contracts or outright ownership the easiest to police. Thus, despite the claim by Otsuka et al. (1992 p. 2012) that risk aversion "provides the most consistent explanation for the existence of a share contract [in farming]," the evidence suggests otherwise.

B. *Beyond Agriculture*

Studies of contracts in nonfarm settings also cast doubt on risk-sharing and support transaction costs. William S. Hallagan (1978) examined gold-mining contracts from the 1800's in California when it was common for miners to share the output from jointly owned ore claims. Hallagan found that incentives, not risk-sharing, best explained the prevalence of share-contracting among early gold miners. Keith B. Leffler and Randal R. Rucker (1991) found that the choice between lump-sum and per-unit timber sales contracts are best explained by variables proxying enforcement and measurement costs. Their tests of risk variables as factors influencing contract choice failed to support predictions of the risk-sharing theory. Similarly, J. Harold Mulherin (1986) found that natural-gas contract provisions were best explained by bilateral contracting hazards while risk-based explanations had no predictive power.

The franchise contract is a sharing arrangement between the franchisor and the franchisee. Unlike farmland contracts, where the choice is between renting land by cash or by share, the most likely choice is between a franchised retail outlet (share contract) and a hired manager (fixed-payment contract). For this choice, assuming that the franchisee is risk-averse and the franchisor is risk-neutral, the risk-sharing model predicts that greater variability will result in more fixed-payment contracts (hired managers). Lafontaine (1992) finds that the extent of franchise contracting (she does not use contract-level data) is best explained by moral-hazard variables on both sides of the contract. At the same time, Lafontaine does not find support for the idea that franchise contracts are effected by "risky" conditions. Moreover, as with farming, risk-preference assumptions are crucial, making a definitive risk-sharing test elusive. If, as some have argued, the franchisees are more risk-averse, then risky situations call for a fixed-payment contract; the prediction is reversed with alternative preferences.

III. Conclusion

Despite the overwhelming use of risk aversion to explain contracts in theoretical models, the supporting evidence has been weak. The accumulated findings of many studies (see Table 1; also see Oliver Williamson [1989] and Allen and Lueck [1995]) not only cast doubt on the importance of risk-avoidance in determining contract design but also support the risk-neutral transaction-cost approach, which stresses multiple margins for moral hazard and enforcement costs. Indeed, even contemporary theorists (e.g., Bengt Holmstrom and Milgrom, 1991) are beginning to downplay risk aversion in contracting models. At the same time, our evidence does not necessarily suggest widespread risk neutrality, but rather that risk aversion is not useful in explaining contracts and, in fact, tends to

distract economists from other important forces shaping contracts.

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