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REAFFIRMING RELATIONSHIP-SPECIFIC INVESTMENTS

Comments on Miwa and Ramseyer's 'Rethinking Relationship-Specific Investments'

Scott E. Masten*

I, too, have a work-related anecdote from my youth to relate. During one summer break from college, I had a job on the night shift in the canning plant of a Coca-Cola bottling franchisee in my hometown in New Hampshire. The process of canning tonic (known as "soda" outside of New England) consisted of three stages, beginning with the fabrication of cans in a room at one end of the building and concluding with the filling and sealing operations in a room at the other end. In between, workers in a third room inspected cans as they arrived by conveyor from the fabrication facility, loaded empty cans onto pallets for storage, and unloaded cans of the appropriate type (Coke, Tab, and Shasta) back onto the conveyor to assure a continuous supply of containers to the filling room "downstream."

The year was 1976 and Oliver Williamson's Markets and Hierarchies, published just the year before, had not yet found its way into the undergraduate curriculum. Nevertheless, I recall finding it curious at the time to learn that the can fabrication operation in the adjoining room was a separate company from the bottling franchise that stored, filled, and, ultimately, distributed the cans.

If youthful experience colors one's perceptions, it would seem that I, rather than Professors Miwa and Ramseyer, should be the one expressing skepticism about the importance of relationship-specific investments in organization decisions. Whereas the separate ownership of can fabrication and filling operations, despite the location specificity of the facilities, at least appears to conflict with the relationship-specific investment hypothesis, the circuit factory in which one of them once worked exhibited neither specific investments *nor* special governance arrangements — exactly as the theory predicts! What's more, as I will argue below, the same can be said of virtually all of their evidence.

To be fair, Miwa and Ramseyer neither intend nor claim to refute the relationship-specific investment hypothesis. On the contrary, they

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say the theory makes sense.¹ And the evidence — their “empirical vacuum” derogation notwithstanding — does, by their own account, provide “substantial evidence of the relation between RSIs and governance.”² The problem, as Miwa and Ramseyer see it, is that settings in which investments *are* large and specific enough to affect the choice of governance arrangements are so few and anomalous as to render the theory irrelevant for understanding the organization of everyday industries. Modern manufacturing simply entails far fewer relationship-specific investments than transaction-cost economists would have us believe. And where such investments do arise, reputation and standard market contracting adequately deal with the associated problems. As a logician might put it, the theory, though valid, lacks existential import.

Miwa and Ramseyer are not the first, nor even the most prominent, scholars to express reservations about the theory’s domain. Indeed, no less an authority on the transaction-cost determinants of organizational form than Ronald Coase has questioned the importance of specific investments on repeated occasions — most recently, in his extensive critique of Klein, Crawford, and Alchian’s analysis of General Motors’ 1926 acquisition of Fisher Body.³ From his observations of the U.S. automotive industry in the 1930s, Coase saw that “suppliers were often unwilling to sell too great a proportion of their output to one customer”⁴ for fear that that customer might take advantage of its position “to drive down the price to a level which yields no return on such investments.”⁵ Further inquiry, however, led him “to doubt not the reality of this risk, but its importance”⁶: “Even though the costs of contracting [may] increase more than the costs of vertical integration as assets become more specific and quasi rents increase, vertical integration will not displace the long-term contract unless the costs of contracting become greater than the costs of vertical integration”⁷ And that, Coase adds incisively, “might never happen for

1. Yoshiro Miwa & J. Mark Ramseyer, *Rethinking Relationship-Specific Investments: Subcontracting in the Japanese Automobile Industry*, 98 MICH. L. REV. 2636, 2637 (2000).

2. *Id.*

3. See R.H. Coase, *The Acquisition of Fisher Body by General Motors*, 43 J.L. & ECON. 15 (2000) [hereinafter Coase, *Fisher Body*] (criticizing Benjamin Klein et al., *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297 (1978)).

4. R.H. Coase, *The Nature of the Firm: Origin, Meaning, Influence*, 4 J.L. ECON. & ORG. 3, 44 (1988) [hereinafter Coase, *Nature of the Firm*].

5. *Id.* at 42.

6. *Id.* at 44.

7. *Id.* at 43.

any value of quasi rents actually found."⁸ The reason is that "the propensity for opportunistic behavior is usually effectively checked by the need to take account of the effect of the firm's actions on future business" and by "contractual arrangements."⁹

The importance of relationship-specific investments to organization is ultimately an empirical question and, as such, Miwa and Ramseyer's claims require an empirical response.¹⁰ Good empirical research is always rooted in theory, however. So before turning to the evidence, some consideration of the underpinnings of the relationship-specific investment hypothesis is in order.

I. THE THEORY

Miwa and Ramseyer summarize the relationship-specific investment hypothesis as follows: "According to this intuition, the scope and size of RSIs can *directly* affect the governance arrangements firms choose. Whether business partners negotiate long-term contracts, spot contracts, equity investments, franchise arrangements, or even mergers can depend *vitaly* on the RSIs at stake."¹¹

Though perhaps intentionally hyperbolic, this characterization nevertheless overstates the role that specific investments play in the theory. To be sure, relationship-specific investments have been prominent, arguably even central, in the "operationalization" of transaction-cost reasoning. But the effect of specific investments on organizational form in the theory is neither direct, exclusive, nor decisive. First, contrary to Miwa and Ramseyer's portrayal of the relationship-specific investment hypothesis as predicting the adoption

8. *Id.* Coase actually goes one step further, declaring: "In any case, I am very doubtful whether there is such a systematic relationship [between specific investments and costs of contracting relative to vertical integration] as that described." *Id.*

9. *Id.* at 44. Remarkably, Coase documents that he formed his views of the importance of relationship-specific investments very early on. The following are excerpts from correspondence from Coase to Ronald Fowler in 1932:

Suppose the production of a particular product requires a large capital equipment which is, however, specialized insofar that it can only be used for the particular product concerned or can only be readapted at great cost. Then the firm producing such a product for one consumer finds itself faced with one great risk — that the consumer may transfer his demand elsewhere or that he may exercise his monopoly power to force down the price

Coase, *Nature of the Firm*, *supra* note 4, at 43 (letter dated March 24, 1932).

My queries about the form of contracts for products requiring large capital equipment has shown me that contractual arrangements can be made to avoid this risk. Thus, the consuming firm may buy the particular equipment itself even though it is in another company's plant. There are a number of other contractual devices which tend to get over this difficulty.

Id. at 45 (letter dated May 7, 1932).

10. I leave it to Klein to respond to Coase's critique, which he does in Benjamin Klein, *Fisher-General Motors and the Nature of the Firm*, 43 J.L. & ECON. 105 (2000).

11. Miwa & Ramseyer, *supra* note 1, at 2638 (emphasis added).

of “extra-contractual governance arrangements,” transaction-cost economists have always regarded contracts and other organizational arrangements as alternative responses to the appropriability hazards engendered by specific investments.¹² Klein, Crawford, and Alchian, for example, expressly identify vertical integration and contracting as substitute devices for curbing opportunism: “The primary alternative to vertical integration as a solution to the general problem of opportunistic behavior is some form of economically enforceable long-term contract. . . . The relevant question then becomes when will vertical integration be observed as a solution and when will the use of the market-contracting process occur.”¹³ The existence of relationship-specific assets, by itself, implies only the desirability of adopting *some* protective governance arrangement but says nothing about which such arrangement will be chosen;¹⁴ determining whether contracts, vertical integration, franchising, rate-of-return regulation, or yet some other organizational structure represents the best (least costly) solution requires incorporation of other considerations into the analysis.

And in fact, asset specificity is just one of a variety of factors the theory identifies as affecting the relative efficiency of alternative governance arrangements. Among the more prominent, especially in relation to contracting, are reputation¹⁵ and the complexity of and uncertainty associated with the transaction.¹⁶ Indeed, complexity and uncertainty have been at least as important as asset specificity in the development of Williamson’s framework.¹⁷ Even in Williamson’s

12. Miwa and Ramseyer subtly shift terminology from choosing among “governance arrangements,” *see, e.g.,* Miwa & Ramseyer, *supra* note 1, at 2637, to choosing among “extra-contractual governance arrangements,” *see, e.g., id.* at 2643, 2644. They also vacillate in qualifying the prediction with a reference to impediments to contracting.

13. Klein et al., *supra* note 3, at 302. Cf. Paul L. Joskow, *Asset Specificity and the Structure of Vertical Relationships: Empirical Evidence*, 4 J.L. ECON. & ORG. 95, 105 (1988) (“Other things equal, we expect the parties more frequently to choose *vertical integration or a long-term contract* as the quasi-rents associated with specific investments become more important and the associated benefits of precommitment increase.” (emphasis added)).

14. *See generally* Klein et al., *supra* note 3; OLIVER E. WILLIAMSON, *MARKETS AND HIERARCHIES: ANALYSIS AND ANTITRUST IMPLICATIONS* (1975) [hereinafter WILLIAMSON, *MARKETS AND HIERARCHIES*]; Oliver E. Williamson, *Transaction-Cost Economics: The Governance of Contractual Relations*, 22 J.L. & ECON. 233 (1979) [hereinafter Williamson, *Transaction-Cost Economics*]; OLIVER E. WILLIAMSON, *THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING* (1985) [hereinafter WILLIAMSON, *ECONOMIC INSTITUTIONS*].

15. *See, e.g.,* Klein et al., *supra* note 3, at 304.

16. *See, e.g.,* WILLIAMSON, *MARKETS AND HIERARCHIES*, *supra* note 14, at 21-24; WILLIAMSON, *ECONOMIC INSTITUTIONS*, *supra* note 14, at 56-60.

17. For example, Williamson’s discussion of impediments to contracting posed by complexity and uncertainty take precedence over his discussion of idiosyncratic investments in *MARKETS AND HIERARCHIES*, *supra* note 14, at 8-10, 20-30. For Williamson’s earlier formulation of the theory, see Oliver E. Williamson, *The Vertical Integration of Production: Market Failure Considerations*, *AM. ECON. REV.*, May 1971 (Papers and Proceedings of the Eighty-Third Annual Meeting of the American Economic Association), 112, especially the

more recent writings, where relationship-specific investment has played a more prominent role, maladaptation problems arise only in the presence of uncertainty and complexity. Thus, Williamson describes adaptation as the central problem of organization¹⁸ and “[t]ransactions conducted under certainty [as] relatively uninteresting.”¹⁹ Similarly, Klein, Crawford, and Alchian ascribe the choice between contracting and integration to the complexity of the transaction: “As we shall see, the costs of contractually specifying all important elements of quality varies considerably by type of asset. For some assets it may be essentially impossible to effectively specify all elements of quality and therefore vertical integration is more likely.”²⁰

All of this has two implications. First, as always where human behavior is subject to influences from multiple sources, predicting the effect of one determinant on the choice of governance form requires that other determinants be held constant. Second, because we can never control for all of the factors that affect such decisions, our theories can only yield probabilistic, never deterministic, predictions. The theory does not say, as Miwa and Ramseyer would have it, that transactors *will* adopt extra-contractual governance arrangements when production involves large relationship-specific investments, only that, holding other things (complexity, uncertainty, reputation, and so on) constant, the *likelihood* that some specialized governance arrangement will be adopted increases. Whether that arrangement will be a contract or vertical integration or another arrangement depends on the effectiveness of those alternatives in the prevailing circumstances.²¹

subsection entitled “Contractual Incompleteness,” at 115-17, in which he states that “only when the need to make unprogrammed adaptations is introduced does the market versus internal organization issue become engaging,” *id.* at 113.

18. See Oliver E. Williamson, *Comparative Economic Organization: The Analysis of Discrete Structural Alternatives*, 36 ADMIN. SCI. Q. 269, 277-79 (1991).

19. Williamson, *Transaction-Cost Economics*, *supra* note 14, at 253. Much of the empirical literature also explicitly treats vertical integration as the result of a combination of specific investments and complexity/uncertainty. See, e.g., Scott E. Masten, *The Organization of Production: Evidence from the Aerospace Industry*, 27 J.L. & ECON. 403 (1984); Erin Anderson & David C. Schmittlein, *Integration of the Sales Force: An Empirical Examination*, 15 RAND J. ECON. 385 (1984); Erin Anderson, *Transaction Costs as Determinants of Opportunism in Integrated and Independent Sales Forces*, 9 J. ECON. BEHAV. & ORG. 247 (1988); Bruce R. Lyons, *Contracts and Specific Investment: An Empirical Test of Transaction Cost Theory*, 3 J. ECON. & MGMT. STRATEGY 257 (1994).

20. Klein et al., *supra* note 3, at 301. Later in the article, Klein et al. contrast the problems of contracting for land and employment services: “The primary reason [why land-rental contracts rather than vertical integration can often be used to attenuate opportunistic behavior in agricultural contracts] is because it is rather cheap to specify and monitor the relevant contract terms (the quality of the good being purchased) and to enforce this particular rental contract.” *Id.* at 320. They contrast this with employment contracts “where it is essentially impossible to effectively specify and enforce quality elements (for example, all working conditions and the effort expended by workers) . . .” *Id.*

21. Holding complexity and uncertainty constant (at some nontrivial level), an increase in the level of asset specificity may increase the probability of integration if, for example,

II. THE EVIDENCE

A. Japanese Automotive Subcontracting

Like Coase, Miwa and Ramseyer arrive at their conclusion from observations of the automotive industry, albeit half a continent, an ocean, and more than half a century distant in space and time. In the Japanese automotive supply industry, they inform us, (i) second- and third-tier suppliers, like their erstwhile circuit-producing employer, make few large investments of any type and, a fortiori, few large investments specific to a particular customer, and (ii) the investments of first-tier suppliers, though sometimes large, are at most only model- rather than firm- (relationship-) specific and, with model changes occurring every three or four years, are short-lived.²²

Their account of the industry, they readily admit, is impressionistic: They have no direct measures of specific investments to support their conclusion of the absence of “widespread, substantial physical-asset or human-capital RSIs.”²³ More fundamentally, however, Miwa and Ramseyer’s judgment that the industry lacks large specific investments begs the question of what *large* is. Even if Miwa and Ramseyer were able to provide a precise monetary value for the specific investments in the industry, against what metric could we judge whether or not those values are large? U.S. auto companies spend millions of dollars on model-specific tooling and other investments. How are we to compare these to the value of investments specific to the production of particular components going into the manufacture of jet engines or missiles or the installation of cable television systems? How does the three- to four-year product cycle of automobiles compare with the durability of a sales representative’s investment in knowledge of a manufacturer’s product?

As the discussion of the preceding section indicates, how large and durable specific investments must be to affect the choice of governance in any particular circumstance is something that the theory does not — and cannot — answer. In principle, even very small levels of quasi-rents could be enough to motivate the adoption of protective governance arrangements if those arrangements are low cost. Again, all the theory tells us is that, in any given setting, the probability that the hazards of simple bargains will exceed the costs of alternative governance arrangements increases as the level of specific investments (and associated quasi-rents) increases.

increased specificity motivates longer-term, and therefore more costly, contracts (relative to integration). But this effect is indirect in that it works through changes in contracting behavior.

22. See Miwa & Ramseyer, *supra* note 1, at 2653-54.

23. *Id.* at 2637.

From this perspective, Miwa and Ramseyer's discursive account of the industry appears to line up pretty well with the relationship-specific investment hypothesis: Small, higher-tier suppliers in the industry use fairly standard assets to produce (to order) relatively simple components but, at the same time, also do not enjoy the protections of long-term contracts or other specialized governance structures. First-tier and larger, second-tier suppliers, by contrast, (i) make larger investments, some of which are specific to a particular customer's product, and (ii) are, correspondingly, the ones more likely to employ cross-equity holdings and other safeguards.²⁴ The *largest* specific investments, if the theory is correct, would not be found among suppliers at all but within the automobile manufacturers themselves. The organizational puzzle of the Japanese automotive industry — if indeed there is one — is how manufacturers and suppliers managed to get by for so long using relatively short-term, nondetailed contracts *despite* the sizeable model-specific investments involved.²⁵

B. *Statistical Analysis*

Though Miwa and Ramseyer regard their discursive account as providing the most compelling evidence, they nevertheless supplement their impressionistic evidence with a more formal statistical analysis. Like others who have conducted empirical studies in this area, Miwa and Ramseyer do not have direct measures of the explanatory variables of interest and must settle for proxies. Although the quality of the proxies will affect our confidence in the results, this alone is not a reason to forgo the analysis.

The organizational arrangement they wish to explain is the holding by assemblers of equity investments in their suppliers. Although they include a variety of control variables in their estimations, the two variables of particular interest are (i) the percent of a supplier's output going to a given assembler and (ii) whether the supplier is a member of one (and only one) assembler's supplier association. Of these two, only the first, the assembler's share of the supplier's output, is consistently statistically significant, indicating that an assembler is more likely to have significant equity holdings in a supplier for whom it is a major customer.

To many, this may seem like pretty strong support for the relationship-specific hypothesis; in plain English, the results say that

24. Miwa and Ramseyer's distinction between model-specific and relationship-specific investments is irrelevant; all that matters is the difference between the value of the asset in its first-best use (supplier B producing model X for customer A) and its value if the transaction between A and B does not take place.

25. See Klein, *supra* note 10, at 127 (attributing this success to reputational considerations).

the more dependent is a supplier on a particular customer for its sales, the more likely the transactors are to engage in cross-equity holdings. Miwa and Ramseyer, however, deploy a rather elaborate argument to suggest that membership in a single supplier association (LoneClub) is a better measure of specific investments than a supplier's dependence on its principle customer and that the insignificance of the former shows that specific investments are not important.

The argument itself is problematic but, even if it were valid, reasons exist for not placing too much emphasis on the LoneClub results. First, whether to belong to a supplier association and, if so, to how many, are themselves decision variables. As a statistical matter, results of standard regressions containing endogenous variables as "right-hand-side" explanatory variables have no meaningful interpretation. The point can be illustrated with a simple example: Suppose, as some have argued, that belonging to a supplier association is itself a means of protecting against hold up and that supplier association membership and equity investments are alternative (substitute) ways of securing that protection.²⁶ By reducing the risk of appropriation, association membership could thus very well decrease the need for equity investments, resulting in a negative correlation between association membership and cross-equity holdings. The point is that, without a more fully specified model of association membership and its interactions with equity holdings, we can infer very little from these results. Also troubling is the fact that Miwa and Ramseyer's regressions show no significant difference between belonging to no association, one association, or multiple associations. If membership in an association is a mere formality, or if the associations themselves are "trivial social clubs"²⁷ with no effect on firm behavior, this variable becomes a very thin foundation indeed on which to reject the theory.

C. *The Broader Empirical Literature*

The empirical literature examining the determinants of organizational form and contract design is extensive, certainly far too large to review here. Suffice it to say, surveys of the literature have all come to virtually the same conclusion, namely, that transaction-cost economics has been profoundly successful empirically.²⁸ The industries analyzed

26. Miwa and Ramseyer, for example, describe Gilson and Roe as arguing that cross-shareholdings and membership in business groups help to address the problem of appropriability. See Miwa & Ramseyer, *supra* note 1, at 2644.

27. *Id.* at 2661.

28. See, e.g., Howard A. Shelanski & Peter G. Klein, *Empirical Research in Transaction Cost Economics: A Review and Assessment*, 11 J.L. ECON. & ORG. 335 (1995); Keith J. Crocker & Scott E. Masten, *Regulation and Administered Contracts Revisited: Lessons from Transaction-Cost Economics for Public Utility Regulation*, 9 J. REG. ECON. 5 (1996); Bruce R. Lyons, *Empirical Relevance of Efficient Contract Theory: Inter-Firm Contracts*, OXFORD

include such seemingly quotidian settings as ocean shipping,²⁹ overland trucking,³⁰ marketing and distribution,³¹ engineering subcontracting,³² and even automotive supply,³³ not to mention more exotic industries like petroleum coke refining.³⁴ Some even use measures similar to Miwa and Ramseyer to reflect the specificity of investments; Lyons, for example, regards the share of output taken by a firm's most important customer as a measure of the firm's vulnerability to hold up.³⁵ Asset specificity is not the only variable shown to affect governance form in these studies, nor are specific investments the critical variable in every setting. But as Michael Whinston wrote recently, the prediction that an "increase in quasi-rents will increase the likelihood of vertical integration . . . is so far consistent with nearly all of the existing empirical literature."³⁶

REV. ECON. POL'Y, Winter 1996, at 27; Régis Coeurderoy & Bertrand Quélin, *L'économie des coûts de transaction: un bilan des études empiriques sur l'intégration verticale* [*Transaction-Cost Theory: A Survey on Empirical Studies on Vertical Integration*], 107 REV. D'ECONOMIE POLITIQUE 145 (1997); Scott E. Masten & Stéphane Saussier, *Econometrics of Contracts: An Assessment of Developments in the Empirical Literature on Contracting*, 92 REV. D'ECONOMIE INDUSTRIELLE 215 (2000).

29. See, e.g., Stephen Craig Pirrong, *Contracting Practices in Bulk Shipping Markets: A Transactions Cost Explanation*, 36 J.L. & ECON. 937 (1993).

30. See, e.g., THOMAS N. HUBBARD, HOW WIDE IS THE SCOPE OF HOLD-UP-BASED THEORIES? CONTRACTUAL FORM AND MARKET THICKNESS IN TRUCKING (Nat'l Bureau of Econ. Research, Working Paper No. 7347, 1999); JACK A. NICKERSON & BRIAN S. SILVERMAN, WHY AREN'T ALL TRUCK DRIVERS OWNER-OPERATORS? ASSET OWNERSHIP AND THE EMPLOYMENT RELATIONSHIP IN INTERSTATE FOR-HIRE TRUCKING (Harvard Business School, Working Paper No. 00-01, 1999).

31. See, e.g., Anderson & Schmittlein, *supra* note 19; Anderson, *supra* note 19; Erin Anderson & Anne T. Coughlan, *International Market Entry and Expansion via Independent or Integrated Channels of Distribution*, 51 J. MARKETING 71 (1987); George John & Barton A. Weitz, *Forward Integration into Distribution: An Empirical Test of Transaction Cost Analysis*, 4 J.L. ECON. & ORG. 337 (1988); Jan B. Heide & George John, *The Role of Dependence Balancing in Safeguarding Transaction-Specific Assets in Conventional Channels*, 52 J. MARKETING 20 (1988).

32. See, e.g., Bruce R. Lyons, *Contract and Specific Investment: An Empirical Test of Transaction Cost Theory*, 3 J. ECON. & MGMT. STRATEGY 257 (1994).

33. See, e.g., Kirk Monteverde & David J. Teece, *Supplier Switching Costs and Vertical Integration in the Automobile Industry*, 13 BELL J. ECON. 206 (1982); Kirk Monteverde & David J. Teece, *Appropriable Rents and Quasi-Vertical Integration*, 25 J.L. & ECON. 321 (1982); Scott E. Masten et al., *Vertical Integration in the U.S. Auto Industry: A Note on the Influence of Transaction Specific Assets*, 12 J. ECON. BEHAV. & ORG. 265 (1989).

34. See, e.g., Victor P. Goldberg & John R. Erickson, *Quantity and Price Adjustment in Long-Term Contracts: A Case Study of Petroleum Coke*, 30 J.L. & ECON. 369 (1987).

35. Lyons, *supra* note 32.

36. Michael D. Whinston, *On the Transaction Cost Determinants of Vertical Integration*, at 2 (Feb. 9, 2000) (unpublished manuscript, on file with author).

III. CONCLUSION

Like the proverbial economist who searches for his car keys under the streetlight rather than in the alley where he lost them because “the light is so much better there,” Miwa and Ramseyer go looking for examples of large relationship-specific investments where the theory says they should be least likely to find them: in the facilities of suppliers rather than in the auto companies themselves. Not finding them there, they conclude that they don’t exist and take the bus home.

Miwa and Ramseyer’s skepticism of the role played by relationship-specific investments in the organization of the Japanese automotive industry is undoubtedly genuine and may even be justified. Although the evidence they present does not support their case, additional research may yet prove them right.

At a broader level, skepticism toward specific investment-based explanations is a healthy attitude. The empirical successes of the theory so far combined with the fact that virtually every transaction involves some level of irreversible and unrecoverable investment — if only to cross the street or search out another web page — make it temptingly easy to ascribe any and all observed organizational arrangements to specific investments. Econotribologists³⁷ need to be on guard that specific investments do not become the handy but empty catchall explanation that, in succession, transaction costs, risk aversion, and asymmetric information have been. Progress on the road to understanding the causes and consequences of organization requires, as Oliver Williamson is fond of pointing out, “modest, slow, molecular.”³⁸

37. Econotribology, n., the study of economic frictions: transaction-cost economics. [neologism from ECONO(MICS) + TRIBOLOGY, the science of the mechanisms of friction.]

38. OLIVER E. WILLIAMSON, *THE MECHANISMS OF GOVERNANCE* 13 (1996).